JPRS 70560

30 January 1978

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

ENGINEERING AND EQUIPMENT

No. 39

DISTRIBUTION STATEMENT A
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BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS 70560	2.	3. Recipient's Accession No.

4. Title and Subtitle

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS - ENGINEERING AND EQUIPMENT, No. 39

5. Report Date 30 January 1978

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

Joint Publications Research Service
1000 North Glebe Road
Arlington, Virginia 22201

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Address

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstracts

The report contains abstracts and news items on aeronautical, marine, mechanical, automotive, civil and industrial engineering, related research and development, and engineering materials and equipment.

17. Key Words and Document Analysis. 17a. Descriptors

USSR
Eastern Europe
Aeronautics
Industrial Engineering
Marine Engineering
Stress Analysis
Turbines
Metrology

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group   1A, 13H, 13J, 14B

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Unlimited Availability Sold by NTIS Springfield, Virginia 22151	UNCLASSIFIED	*100*
	20. Security Class (This Page) UNCLASSIFIED	22. Price *PCA05*

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

ENGINEERING AND EQUIPMENT

No. 39

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VINOGRADOV, V. I., and KAZANTSEV, V. F.

[Abstract] Using indirect extrusion with a smooth cylindrical punch with a
flat end as an example, the authors propose a method for analysis of process-
es of extrusion with the application of radial ultrasonic oscillations, in-
cluding an estimate of the influence of ultrasonic oscillations on external
friction at the point of contact of the die with the blank as well as the
yield stress of the material of the blank. The stresses arising at the focus
of plastic deformation when standing radial ultrasonic waves are excited in
it are calculated. The selection of a method of applying the oscillations to
the focus of plastic deformation is determined. Figures 3; references 8:
7 Russian, 1 Western.

INFLUENCE OF STEADY FLOW ON ACOUSTICAL CHARACTERISTICS OF PERFORATED BARRIERS

OSIPOV, B. I., STAROBINSKIY, R. N., and YUDIN, YE. YA., Central Scientific
Research Institute of Motor Vehicles and Engines

[Abstract] Results are presented from studies of the acoustical character-
istics of typical motor vehicle mufflers as a function of their structural
parameters and the velocity of the air flowing through the apertures. The
studies were performed at frequencies of 200-2,500 Hz at sound pressures of
up to 128 dB. Factors studied included the level of sound pressure, gas ve-
locity through the apertures and structural parameters of the perforated bar-
rier in the muffler. Work in this area has been performed for various areas
of technology using various methods with essentially different test installa-
tions. Therefore, the literature does not contain sufficient data on the
properties of perforated barriers to allow intelligent planning of mufflers.
The experimental data show that the frequencies of discrete total components
of the noise generated are directly proportional to the velocities of the
steady air flow through the apertures. The active portions of the acoustical
impedance of the barrier at the frequencies of the total components become
negative throughout the entire range of frequencies studied. The impedance
has a loop-like shape at high Strouhal numbers, a result of the development
of discrete components in the noise spectrum. Figures 3; references 6: 1
Russian, 5 Western.

USSR

ON THE THEORY OF ACOUSTICO-OPTICAL PHENOMENA IN THE CASE OF HIGH INTENSITY
LIGHT

SHKERDIN, G. N., PROKLOV, V. V., and GULYAYEV, YU. V., Institute Radio En-
gineering and Electronics, Academy of Sciences USSR

[Abstract] A theoretical study is made of the diffraction of a high-power
laser beam by sound when the laser beam influences the intensity of the sound
wave propagating in a crystal and, consequently, changes the scatter process
per se. Disregarding the change of intensity of the zero order of diffrac-
tion of the light during passage through a specimen the authors derived an
integral equation which describes the change of amplitude of the acoustical
wave in the crystal as a function of two coordinates and of time. A solution
of this equation provides the amplitude of the acoustical wave and amplitudes
of the electromagnetic waves in Stokesian and anti-Stokesian diffraction or-
ders for the case of low-frequency sound when the light and the sound propa-
gate within the crystal almost perpendicular to one another. It is shown
that a considerable amplification of the sound can occur as a result of the
acoustico-optical interaction in the case of Stokes diffraction. As a re-
sult the input power of the sound required for an effective control of the in-
tensity of the light beam can be reduced greatly, i.e., as much as 20 dB in
the stationary case for moderate light intensity (~ 50 Mw/cm^2) and typical
acoustico-optical material. Biblio 15

USSR   UDC   533.6.011.5

BODY FLOW AROUND A THIN WING BY A HYPERSONIC GAS STREAM

GOLUBINSKIY, A. I., and GOLYBKIN, V. N., Central Aerohydrodynamic Institute imeni N. Ye. Zhukovskiy

[Abstract] A study is made of the flow around the windward surface of a thin long-span wing at a certain angle of attack in a hypersonic gas stream. The leeward surface is located in the area of aerodynamic shadow, and the main portion of the load is on the windward surface. The flow around the windward surface is studied within the framework of the theory of the shock layer, introducing the small parameter ε which defines the ratio of densities at the strong compression jump. A parabolic compression jump form is found and used to construct the flow around a flat delta wing. Figure 1; references 8: 7 Russian, 1 Western.

USSR   UDC   621.5

CONSTRUCTION OF VERTICAL MANEUVERS OF AN AIRCRAFT IN THE ATMOSPHERE

ZHEVNIN, A. A., and TOLOKNOV, V. I., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] The results here presented fall in the area of flight mechanics and concern the construction of vertical maneuvers required to bring a flight vehicle to an assigned final status at an assigned moment in time when there is uncertainty. The flight vehicle is mathematically modeled by nonlinear, nonsteady differential equations describing both the translational motion of the center of mass and its rotation about its center of mass. The essence of the method presented is continuous observation of the actual position and formation of control actions according to a first method algorithm and a nonlinear algorithm defining the procedure of solution of the supplementary linear boundary-value problem. The method suggested in the work, which allows flexible reactions to actual positions developing during flight regardless of their causes, are effective when some of the parameters of the flight vehicle are uncertain and when there is unavoidable delay in actualizing recommended controlled actions due to the finite speed of the computers on which the nonlinear algorithms are run. References 7 (Russian).

EXPERIMENTAL STUDY OF WING DRAG AT SUPERSONIC VELOCITIES

BRODETSKIY, M. D., KOSORYGIN, V. S., RAFAELYANTS, A. A., and CHEREMUKHIN, G. A., Institute of Theoretical and Applied Mechanics, Siberian Branch of the Academy of Sciences USSR, Novosibirsk

[Abstract] The wing drag at supersonic velocities and at near-zero angles of attack is determined here from measurements with a balance only, without integration of the static-pressure field. Instead, a wing is tested with two different conic cover plates and the two drag components (friction and wave resistance) for the wing alone are each estimated by extrapolation and curve fitting. This method has been applied to five model foils, all with symmetric parabolic profiles but each with a different relative thickness and a different set of conic cover plates. Measurements were made at Mach 2.03-4.04, with the angle of attack within $\pm 2°$, and the Reynolds number referred to the geometric chord varying from $5.42 \cdot 10^6$ to $10 \cdot 10^6$ so as to correspond to the transition range from a laminar to a turbulent boundary layer. The results are compared with data according to the linear theory and with data from drain tests also performed on these foils. Figures 5; references 8: 5 Russian, 3 Western.

DEVELOPMENT OF FATIGUE CRACKS IN A PANEL OF A HERMETIC FUSELAGE

KAPLUN, A. B., and KULIYEV, V. D.

[Abstract] The effect of acoustic pressure on development of fatigue cracks in a hermetic aircraft fuselage is evaluated theoretically from the standpoint of fracture mechanics. The dependence of the cracking rate (rate of change of the crack length), in an elastoplastic body under acoustic loads, on maximum and minimum stress as well as on the ductility of the material is expressed by a fourth-power law. Pressure drops both inside and outside the fuselage are considered. Numerical results are shown which depict a typical crack development during a single flight. They indicate that even at low levels of acoustic stress, a combination of acoustic load with cyclic variation of the internal pressure can appreciably reduce the life of a hermetic fuselage. Figures 2; references 3: 2 Russian, 1 Western.

EFFECT OF SLOTS ON THE EFFECTIVENESS OF WING AND CONTROLS MECHANIZATION DURING SEPARATION FLOW

GULYAYEV, V. V., MIKHAYLOV, A. A., and NISHT, M. I.

[Abstract] A numerical method has been developed for analyzing the effect of slots on the mechanization of a wing and controls in an incompressible non-viscous medium. The gist of this effect lies in adding more vortical surfaces during streamline flow. The method is illustrated here in the case of separation flow around bearing surfaces of a wing with a flap and an interceptor as well as braking panels. An analysis of the results indicates that installation of the breaking panels with a slot facilitating the formation of a vortex trail will make these panels more effective. Figures 5; references 4 (Russian).

UNIFORMLY ACCURATE CONFORMAL MAPPING OF THE EXTERIOR OF A CIRCLE ON THE EXTERIOR OF A WING PROFILE

MONAKHOV, N. M.

[Abstract] Successive approximations do not yield a function which will conformally map a circle on a wing profile with uniform accuracy when that profile is curvilinear with a blunt trailing edge. A more uniformly accurate mapping is achieved with a local irregular function of $O(\epsilon^2)$ accuracy with the "external" regular function of the first approximation. The angle of the zero-lift force, on which all aerodynamic characteristics of the profile depend, can then be determined with $O(\epsilon^4)$ accuracy. Figure 1; references 2 (Russian).

OPTIMAL DESIGN OF A MULTIPURPOSE AIRCRAFT

KOZHEVNIKOV, YU. V.

[Abstract] The main features of a multipurpose aircraft are the invariance
of its basic design parameters and the adaptability of its control character-
istics to all specific applications. The problem of optimizing the basic de-
sign parameters and of programming the flight is considered here in the case
of a three-stage aircraft for putting a payload into a system of trajectories
characterized by a statistical distribution of parameters. For simplicity,
both the initial and the final trajectory of the payload are assumed to lie
in the plane of a great circle in a centripetal and Newtonian gravitational
field of the earth. The problem is solved, with the minimum cost of large-
scale service, along finite random trajectories as the optimality criterion.
The result is universally applicable, in a sense, because absolute values of
masses and fuel consumption rates have not been entered into the conditions
of the problem. References 3 (Russian).

SIMULATING THE PROXIMITY EFFECT OF THE GROUND SURFACE ON THE AOERODYNAMIC
CHARACTERISTICS OF A WING WITH A PLANE SHIELD OF FINITE DIMENSIONS

YERMOLENKO, S. D., and ROGOZIN, YU. A

[Abstract] A plane shield in the form of a thin panel or plate is often used
in testing of aircraft models for simulating the proximity effect of the
ground surface in actual flight. Such a shield is comparable in size to the
model, perhaps somewhat larger, and yet its effect on the aerodynamic charac-
teristics is assumed to be the same as that of an infinitely large shield
simulating the earth. The error of this assumption is evaluated here as a
function of the ratio of shield dimensions to model dimensions. Both shield
and model are regarded as thin plane rectangular foils and the larger one
(the shield) aligned at a zero angle of attack with respect to the velocity
of a laminar stream. Both are subdivided into rectangular elements and then
replaced by a equivalent discrete vortices. The effect of an infinitely
large shield is calculated by the method of mirror reflection. The results
of a numerical solution reveal that, if the length of the shield is at least
five times that of the wing chord, the effect of such a shield is almost the
same as that of an infinitely large one. The error due to angular misalign-
ment of the shield decrease fast with increasing distance from the wing.
Figures 7; reference 1 (Russian).

SUPERELEMENT METHOD OF DESIGNING A HELICOPTER FUSELAGE

AKSENOV, O. M., and BURMAN, Z. N.

[Abstract] Structural complexity and irregularity of objects as well as
limited computer capacity make it necessary to perform strength calculations
for the design of such objects by the superelement method. The theory of this
method is based on force analysis and superposition of initial strains. The
algorithm is shown here in matrix form, first covering a regularized structure
without notches and then accounting for notches in substructures either be-
fore or after the parts have been joined. Two groups in the joint structure
are considered: longitudinal and transverse, as in the case of a helicopter
fuselage. The distribution of an external load and the moments on the hoops
at the nodal points are calculated here for such a structure. Typical numeri-
cal results are found to agree closely with those obtained by conventional
design calculations. Figures 2; references 7: 6 Russian, 1 Western.

ONE CRITERION FOR ESTIMATING THE STABILITY OF MULTIPLY CONNECTED AUTOMATIC
REGULATION SYSTEMS IN A SPACE OF VARIABLE PARAMETERS

PETROV, B. N., Academy of Sciences USSR, GUSEV, YU. M., Ufa Aviation Insti-
tute, IL'YASOV, B. G., Ufa Aviation Institute, KOLPAKOVA, N. P., and KUZNET-
SOV, V. I., Moscow Aviation Institute

[Abstract] Analysis of the stability of multiply connected automatic regula-
tion systems (MSAR) frequently requires that necessary and sufficient condi-
tions of stability of MSAR be stated in an assigned limited area G of the
space of variable parameters of the system. A study is made of the problem
of analysis of the stability of a multidimensional system of this type with
a number of variable parameters belonging to a certain assigned finite area.
An algebraic criterion is produced allowing the stability of the MSAR to be
estimated as its parameters change within fixed limits. References 2 (Russian).

SYNTHESIS OF NONLINEAR SYSTEMS WITH ASSIGNED DYNAMIC CHARACTERISTICS

ORURK, I. A., and KONOVALOV, A. S., Leningrad Institute of Aviation Instruments

[Abstract] This work presents a method of synthesis of nonlinear systems
with assigned (desired) dynamic characteristics. Since it is intended for
complex high order systems, the method is constructed in such a way that it
can be used as an algorithm for programming of computers. The task of syn-
thesis is analyzed in the following statement. It is assumed that the struc-
ture of the nonlinear system and a portion of its parameters are fixed. The
remaining unknown parameters of one or various elements are to be determined
from the condition of the best reproduction of the assigned transient pro-
cess in a defined sense (or of a group of indicators of the quality of the
transient process, such as speed, maximum deviation in the transient mode,
oscillation) with perturbations of a predetermined form, with assurance of
stability of the system. The method studied is based on generalized lineari-
zation of nonlinearities which, in contrast to harmonic linearization, places
no limit on the form of the input functions of nonlinear elements and the
approximation of the desired dynamic characteristics of the system. In the
first stage of solution of the problem, the dependences between variable par-
ameters are defined; the second stage, conditions are introduced which assure
stability and coarseness of the system synthesized. Figures 4; references
4 (Russian).

GROUP-THEORY SOLUTION TO THE PROBLEM OF OPTIMALLY CONTROLLING A LAMINAR
BOUNDARY LAYER

GARAYEV, K. G.

[Abstract] The control of a process describable by a system of nonlinear
partial differential equations with controls as boundary conditions is op-
timized by continuous vector functions which minimize a functional, with
isoperimetricity and the original equations satisfied at every point of the
domain. The problem is reduced here to the Lagrangian formalism and its
invariancy defined in terms of an r-parametric group of transforms, also the
Noether theorem is brought in with a corollary pertaining to the maximum
number of linearly independent conservation laws. These general concepts are

now applied to the optimal control of a thermal boundary layer, namely determination of the optimum injection velocity for minimizing the heat transfer from a hot gas stream to a plate, and a solution is obtained in closed form without a degree of freedom in the boundary conditions. References 9: 7 Russian, 1 German, 1 Western.

AXISYMMETRIC TRANSIENT INTERACTION BETWEEN A SHOCK WAVE AND A BARRIER INSIDE A CYLINDRICAL PIPE

DUBROVSKAYA, L. I., and KOMAROVSKIY, L. V.

[Abstract] A cylindrical pipe is considered with a stationary or movable piston closing it at one end and the other end opening into a gas-filled space. A shock wave is generated either by motion of the piston or by rupture of a diaphragm located in any section along the pipe. The parameters of gas dynamics at any instant of time during the transient period are calculated by the finite-difference method of solving the equations of axisymmetric flow for a nonviscous and thermally nonconducting gas. The resulting one-dimensional Riemann problem is solved everywhere by iteration with exact formulas. In this way, velocity and pressure fields in the gas discharging at the open end can be determined at any given instant of time. Figures 3; references 8 (Russian).

EXPERIMENTAL STUDY OF THE EFFECTIVENESS OF A GASEOUS SHIELD IN A SUPERSONIC AXISYMMETRIC NOZZLE

VOLCHKOV, E. P., KOZ'MENKO, V. K., and LEBEDEV, V. P., Institute of Thermophysics, Siberian Branch of the Academy of Sciences USSR, Novosibirsk

[Abstract] A shield of cooling gas is often used as thermal protection of channel walls. Its effectiveness in an axisymmetric nozzle consisting of a subsonic convergent segment and a supersonic divergent segment was studied experimentally in a continuous-duty wind tunnel, with a main stream of air

entering at a velocity of 14-15 m/s under an inlet pressure of $(5-10)\cdot 10^5$ N/m^2 and leaving at Mach 3.4, the stagnation temperature within the 297-307 K range. A shield was produced by injection of secondary air through an annular orifice before the nozzle entrance at 80-100°C, at a relative mass rate varying from 0.05 to 0.30. Measurements have yielded profiles of static pressure and stagnation temperature along the nozzle wall and across the boundary layer. The effectiveness of the air shield, evaluated in terms of a dimensionless complex involving the Reynolds number and the dynamic viscosity at stagnation temperature in the main stream and in the secondary stream, is found to increase with higher injection ratio but differently within the two nozzle segments. The shield effectiveness decreases along the nozzle, slower within the supersonic than within the subsonic zone. The experimental data differ from theoretical pertaining to a zero-gradient subsonic flow but, with the velocity gradient and compressibility of the medium taken into account, can be fit into a single expression. Figures 6; references 6: 4 Russian, 2 Western.

STAGNATION OF A SUPERSONIC STREAM BEHIND A CURVILINEAR SHOCK WAVE FOLLOWING AN ISENTROPIC COMPRESSION

DULOV, V. G., Computer Center at the Siberian Branch of the Academy of Sciences USSR, Krasnoyarsk, and SHCHEPANOVSKIY, V. A., Krasnoyarsk State University

[Abstract] An analytical study is made of supersonic flow of an ideal gas past solids with streamlined contours. The nonuniform region consists of a zone where isentropic compression occurs and a zone of vortical flow separating the former from the uniform main stream. The flow in the first zone is described by the exact solution to an axisymmetric equation for an ideal gas with a variable entropy, this being an ordinary differential equation with respect to the characteristic function. The flow in the second zone is described by an approximate solution to the Euler equation for an isentropic gas. The two zones are collocated on the basis of mass and momentum conservation as well as coupling at their boundary. Calculations are made at the axis, and the conditions are established under which the wave, assumed to be curvilinear and weak, will reach the axis. The results of this analysis are applied to an air intake, for which the pressure loss coefficient and the pressure recovery coefficient are calculated as functions of the sector angle. The effect of vorticity on the aerodynamic characteristics is thus also established. Figures 4; references 4 (Russian).

SUDDEN OPERATION OF A SUPERSONIC NOZZLE WITH OVEREXPANSION

GVOZDEVA, L. G., and ZHILIN, YU. V., Institute of High Temperatures, Academy
of Sciences USSR, Moscow

[Abstract] Results are presented from experiments performed over a broad
range of parameters, intended to refine the wave picture of flow and dis-
cover new startup modes when the flow separates within a nozzle, jets are
formed and no uniform flow picture occurs. It was found in these studies
that as the Mach number decreases in the incident wave the ratio of the area
of the cross section of the nozzle to the critical cross-sectional area in-
creases, modes arise similar to those with overexpansion in steadily operat-
ing nozzles, i.e., jets are formed within the nozzle. The formation of jets
occurs by interaction of the rotated shock wave with the boundary layer.
Processing of the experimental results showed that the pressure beyond the
separation point is several times greater than the initial pressure and is
determined by the pressure behind the initial wave. Therefore, the form of
the jet and the time of its existence depend on the conditions below the
cross section of the nozzle. If there is sharp expansion at the cross sec-
tion of the nozzle, the dimensions of the jet change in accordance with the
conditions behind the wave. When the initial wave degenerates to an acousti-
cal wave, its flow in the nozzle leads to a state corresponding to the ini-
tial pressure at the cross section of the nozzle. Figures 3; references 9:
1 Russian, 8 Western.

USSR   UDC 699.841:627.8

PROPOSALS FOR IMPROVING THE CONSTRUCTION SPECIFICATIONS AND REGULATIONS SEC-
TION II-A.12-69 "CONSTRUCTION IN SEISMIC REGIONS"

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 9, Sep 77 pp 39-41

MOZHEVITINOV, A. L., and KUKHARTSEV, V. N.

[Abstract] Determination of seismic loads is of utmost importance for evalu-
ating the seismic stability of hydroengineering structures. Chapter 5 of the
Construction Specifications and Regulations Section II-A.12-69 "Construction
in Seismic Regions" covers this subject, but it still contains a few unre-
solved problems and even some error. For simplification, a structure is re-
garded here as a cantilever beam on elastic or rigid support and with an
either plane or three-dimensional state of strain. For the purpose of avoid-
ing problems in new designs, proposals have been submitted by the Scientific
and Technical Council to the USSR Ministry of Power and Electrification on
improvements of this Chapter 5 in Section II-A.12-69. They are based on re-
sults of an engineering review of the Nurek dam. Their main thrust is a re-
finement and correct application of the formulas given here for calculating
the equivalent resultant load due to several seismic vibration modes, the
dangerous direction of seismic wave propagation, and the stability margin.
Figures 1; no references.

USSR   UDC 624.131.536

INFLUENCE OF PORE PRESSURE ON SHEAR DEFORMATION OF MULTIPHASE SOIL

Moscow OSNOVANIYA FUNDAMENTY I MEKHANIKA GRUNTOV in Russian No 5, Sep 77
pp 37-39

TSYTOVICH, N. A., TER-MARTIROSYAN, Z. G., and LEYKAM, A. B., Moscow Institute
of Construction Engineering

[Abstract] Based on many years combined study of the dynamics of left-bank
sliding of the slope of the Akhangara Reservoir, the influence of pore pres-
sure on the development of shear deformation of masses of clay soil making
up the slope is demonstrated. The sliding slope is inclined at 6-10° and
consists of a stratum of 70-80 m thickness, comparatively constant within the
limits of the borehole studies, with a surface area of about 60 ha. The most
active slip displacement occurs at the interfaces between strata, where the
water is under pressure, including the interfaces of the cover loams with neo-
gene clays, limestone with clays and kaolin clay with quartz porphyry. The
slipping is a multilevel phenomenon: one of the most important slip-initia-
tion factors is the variation in water-pressure in the aquifers with time,
and slip displacements results both from deformations of clay layers and

slipping along fixed surfaces. The boundary separating zones of viscous and viscous-plastic flow are variable with the passage of time, making integration with respect to depth and time more difficult. In a model study, after full stabilization was achieved, an increase in water pressure in the lower strata caused renewed slip. Figures 4; references 7 (Russian).

RESULTS OF FIELD TESTING OF PILES IN PERMAFROST

SIVANBAYEV, A. V., SHILIN, N. A., Fundamentproyekt, NIKHOTIN, N. I., Construction Administration of Noril'sk Combine, and NEKLYUDOV, V. S., Fundamentstroy Construction Administration of Noril'sk Combine

[Abstract] Based on a large number of field studies in permafrost regions, a method has been developed for testing of piles in permafrost under gradually increasing impressing, extracting, as well as constant loads within the limits of a single construction area. Pile testing should be performed before the appearance of the second area of nondamping deformations which allows the load-bearing capacity of the piles to be increased for structures experiencing significant deformations, assuming it equal to the value at which the compacting of the soil beneath the tip of the pile decreases. Design of pile foundations on the basis of the second limiting state allows a significant increase in the design load-bearing capacity of the pile, leading in the final analysis to a decrease in construction cost. Test times are significantly reduced and the data produced in testing of the piles can be used for development of more economical plan decisions. Testing of piles in construction areas in the city of Labytnangi showed that the load-bearing capacity of piles driven by the method suggested was 1.3 times greater than that of drilled and filled piles. The new piles can be loaded immediately after driving. Repeated testing of metal piles in Noril'sk showed that the load-bearing capacity of pipe piles without a tip, filled with dirt, was equal to the load-bearing capacity of piles with a tip. Many wooden, metal and reinforced concrete piles were tested in the area of Noril'sk and Dudinka at below-freezing temperatures; consideration of the additional settlin of the piles during use of the structures allows significant increases in design loads.

ON THE INFLUENCE OF WATER-WALL HEAT-MODE INSTABILITY ON OPERATIONAL RELI-ABILITY

DASHKIEV, YU. G., and MIKHLEVSKIY, A. A., Kiev Polytechnic Institute

[Abstract] Temperature measurements of the medium and water-wall metal were used to obtain a quantitative estimate of the instability of the heat and temperature regimes in the lower radiating portion of the P-50 and TPP-210A boilers operating on different types of fuel at the KRIVOROD and TRIPOL'SK state regional electric power plants. In each boiler 20-25 radiometric devices were attached at the places on the water wall where heat loads are highest. The results of 100-500 measurements taken at various time intervals at nominal load were used to obtain the time dependence of the distribution q_t. The derivation of q_t from the mean value $\overline{q}_t$ was determined in the relative coordinates $x = q_t / \overline{q}_t$, which neutralizes the influence of systematic measurement errors. Here the absolute quadratic error for the determination of x did not exceed 0.025-0.030. The maximum range of measurement of the temperature of the wall metal was approximately 80°C even in the absence of internal precipitations ($\overline{R}_{prec} = 0$). As precipitations accumulated the temperature range increased abruptly, reaching 180°C after 5,900 hours ($\overline{R}_{prec} = 14.2 \cdot 10^{-2} m^2 \cdot deg/kw$). Calculations for water-wall operation conditions in the TPP-210A boiler shows that the instability of the heat load greatly influences the permissible value of the thermal resistance of precipitations, and thus the determination of the time between scrubbings. Acid scrubbing of the lower radiation portion of the P-50 and TPP-210A boilers every 7,000-8,000 hours does not guarantee the required service life of the water walls and is one of the main reasons for their high vulnerability to emergency damage. Increased stability of heat liberation is needed (use of the pulverized-coal flow stabilizers developed at the Central Scientific, Research, Planning, and Design Boiler and Turbine Institute and aerating pulverized-fuel nozzles). Figures 4; table 1; references 6 (Russian).

ON COMPUTING THE RECIRCULATION OF GASES INTO THE TOP OF THE FIREBOX OF THE
BOILERS OF HIGH-OUTPUT POWER SETS

MARSHAK, YU. L., OKERBLOM, YU. I., TEMIRBAYEV, D. ZH., BELILOVSKIY, YU. B.,
and ADILBEKOV, M. A.

[Abstract] A method is proposed for computing the aerodynamic conditions for
the entrance of recirculated exhaust gases into the top part of the fireboxes
of the boilers of high-output power sets. The method is a further develop-
ment of an earlier method (TEMIRBAYEV and BELILOVSKIY, TEPLOENERGETIKA No 3,
1977) of designing combustion chamber mixers of gas turbines and HTP turbines
on the basis of the data from studies of subisothermic recirculation models
and single coflowing jets of initially rectangular configuration. The authors
determine the recirculation of the gases into the top part of the firebox of
the boiler of a coal-burning 800-Mw power set. The firebox is square and has
32 tangential burners arranged in four tiers. The boiler is T-shaped. The
computation is for a 13% recirculation factor. For draft operation the rate
of exit flow of the double-entry jets is taken as V_s = 44m/s. In the de-
termination of the jet boundaries the nonisothermicity of the process of propa-
gation of the gas flows is taken into account in the formulas by reducing them
by 10% in accordance with the logarithmic extrapolation of the data. The di-
mensions of the computed nozzles correspond to a jet contraction factor E=1.
Under real conditions the linear dimensions of the nozzles must be increased
by $1/\sqrt{E}$, where E=0.62 in an exit flow of jets from holes in a thin
(≤ 0.3 d_{equiv}) wall, and E=0.9 - 1.0 in an exit flow out of short (1.5 -
3.5 d_{equiv}) nozzles. The results of the computation are tabulated and plotted
in a figure. The recirculation nozzles are spaced at alternating intervals on
the walls of the firebox, with accout taken of the assumed temperature inho-
mogeneity of the main flow. Figures 2; table 1; references 5 (Russian).

STATISTICAL ANALYSIS OF THE TEMPERATURE FIELDS OF THE COMBUSTION PRODUCTS IN
GAS TURBINE ENGINE COMBUSTORS

LYUBCHIK, G. N., and VOLKOTRUB, S. F., Kiev Polytechnic Institute

[Abstract] In an earlier work G. N. LYUBCHIK (TEPLOENERGETIKA No 12, 1975)
showed that reducing the inhomogeneity of the temperature field from δ =
$(T_{max}- T_{mean})$ / $\Delta t_{crit.comb.}$=0.14 to δ = 0.04 reduces the energy losses
from temperature-field inhomogeneity to 1/3 - 1/4. Since a measurement of
T_{max} gives only an approximation of the true maximum temperature and depends

on the total number of measurement points and arrangement of the thermocouples (always difficult because of combustor configuration) the authors investigate the possibility of statistical methods of analyzing the temperature fields of two types of gas turbine engines, the KSVD-GT-50 and GT-9. Using methods of mathematical statistics of A. K. MITROPOL'SKIY (TEKHNIKA STATISTICHESKIKH VYCHISLENIY – Method of Statistical Calculation, Moscow 1971) and D. HUDSON (Statistics for Physicists, Moscow "Mir" 1970) the authors obtain a linearization of the temperature fields and tabulate for the stages of the combustors numerical values for mode characteristics, temperature-field inhomogeneity characteristics, and results of the statistical analysis. It is shown that between $T_{max}-T_{min}$ and σ (standard deviation) there exists a connection with a high correlation factor. Figures 4; tables 4; references 7: 6 Russian, 1 Western in Russian translation.

EXPERIENCE OF TRANSITION OF STEAM GENERATION UNITS TO THE COMBUSTION OF ANTHRACITE POWDER AND FUEL OIL IN INTERSECTING STREAMS

MADOYAN, A. A., KOVALEV, A. P., SHVEDOV, YU. M., IZYUMOV, M. A., IPPOLITOV, A. S., SHCHUKIN, YE. V., GRITSENKO, A. V., and GOLOVKO, V. V., Southern National Heat Engineering Institute, Moscow Institute of Power Engineering, Special Design Bureau of National Heat Engineering Institute, Donbassenergo

[Abstract] Steam generating units in the Donets Basin have been undergoing conversion to the combustion of different fuels in intersecting streams since 1962. Two type TP-150 boilers at the Zuyev Experimental Heat and Electric Power Station of the National Heat Engineering Institute and one type TP-43 boiler at the Voroshilovgrad Regional Electric Power Plant, redesigned according to a plan produced by the Special Design Bureau of the National Heat Engineering Institute in 1973, are currently in operation. These steam generating units have been used to check the basic principles of combustion in a system of intersecting streams with the joint and separate combustion of anthracite powder and fuel oil. The use of the intersecting stream principle helps to increase reliability by decreasing the formation of sulfur anhydride in the combustion chamber and reducing low-temperature corrosion. The concentration of oxides of nitrogen in the flame is also reduced by at least a factor of 2 in comparison with the levels in the boilers before redesign. A combustion chamber with intersecting streams is promising for boiler units operating under variable loads, using various types of fuels, including anthracite powder and fuel oil. Figures 4; references 3 (Russian).

STABILITY OF STRATIFIED STREAMS.   REPORT 1: NONVISCOUS TWO-LAYER FLOW

GOLOVACHEV, YU. G., MARENNIKOVA, O. N., and TARNAVSKIY, A. A., Institute of
Thermophysics, Siberian Branch of the Academy of Sciences USSR, Novosibirsk

[Abstract] The relation between Helmholtz instability and Taylor instability
of a nonviscous stream consisting of two plane-parallel layers is analyzed on
the basis of three different stratification models. The direction of flow
within the perturbation zone is also taken into account, inasmuch as the prob-
lem is an asymmetric one. The theory of small perturbations is applied here
with the conventional Navier-Stokes equations for an incompressible fluid
and the Richardson number as the instability criterion. The velocity pro-
file in the main upper layer is considered uniform, but: in the first model
it begins to slope to zero from the interlayer boundary through the lower
layer so that both layers, in effect, slip relative to one another; in the
second model it begins to slope within the upper layer already so that, in
effect, the latter becomes further stratified; in the third model it slopes
to zero within the lower layer but in two steps at two different rates corre-
sponding to shear flow. Four modes are possible in the third model: the
velocity decreasing first faster and then slower, or decreasing first slower
and then faster, or first increasing to a peak and then decreasing to zero,
or first decreasing to a negative value and then increasing to zero. The
latter two cases correspond to a negative gradient and to flow reversal re-
spectively. Figures 14; references 6: 2 Russian, 4 Western.

BUOYING VELOCITY OF VAPOR BUBBLES IN A SLOT CHANNEL

MIRONOV, B. M., KORNEYEV, S. D., and KURBANOV, KH. K., Moscow Higher Techni-
cal School imeni N. E. Bauman

[Abstract] The buoying velocity of single bubbles is one important factor
in the dynamics of two-phase flow through slot channels, such a bubble usual-
ly becoming oblate during buoyance in a narrow channel. This phenomenon is
analyzed here for the case of vapor bubbles during boiling in a plane-parallel
channel with uniform bilateral heat transfer to the walls. The buoying veloci-
ty is calculated from the balance of three forces on a building up cylindrical
bubble in a stream: lift (proportional to gravity), inertia, and drag. A
solution to the differential equation of bubble growth and buoyance during

heating yields an expression for the velocity which has been checked out experimentally by optical methods and high-speed photography, with proper simulation of a weak gravitation field. Figure 1; references 4 (Russian).

PECULIARITIES OF PROPAGATION OF DETONATION WAVES IN AN AQUEOUS MECHANICAL FOAM FORMED BY A BURNING GAS MIXTURE

KUDINOV, V. M., PALAMARCHUK, B. I., LEBED', S. G., BORISOV, A. A., and GEL'FAND, B. YE., Institute of Electric Welding imeni Ye. O. Paton, Academy of Sciences Uk SSR Kiev; Institute of Chemical Physics, Academy of Sciences USSR, Moscow

[Abstract] Results are presented from studies of the parameters of detonation waves in aqueous foams formed by propane-and-methane-oxygen mixtures of stoichiometric composition. The detonation processes in the foam were studied in pipes with inside diameter 50 mm, length 1.8 m and inside diameter 80 mm, length 3.5 m. The first tube was installed vertically, the second--horizontally, and they were connected with a damping chamber with an inside diameter of 800 mm and a length of 1.5 m, allowing detonation to be excited with the end of the tube either open or plugged. Comparison of the profile of the detonation wave in gas and foam shows that as the liquid content increases, the fall of pressure occurs more smoothly. The peculiarities of detonation waves in foams are thought to be related primarily to the difference in relaxation processes in gases and in the 2-phase foam mixture. Whereas the relaxation zone in the gas is determined primarily by the chemism of the reactions, in the foam the relaxation zone results primarily from exchange processes between the liquid and gas phases. A deeper understanding of the mechanism of detonation in foam and an explanation of the phenomena observed require careful analysis of exchange processes in the relaxation zone and the influence on these processes of the composition and heat physical properties of the gas mixtures. Figures 3; references 5: 4 Russian, 1 Western.

USE OF FILTERLESS RETAINING WALLS AS PROTECTION AGAINST WAVES

BELYASHEVSKIY, N. N.

[Abstract] The design of a concrete retaining wall for protection of the upper slopes of an earth dam without reversing filters (Ye. A. Lubochkov, GIDROTEKHNICHESKOYE STROITEL'STVO No 9, Sep 76) is discussed here with a more thorough emphasis on the physics of the processes occurring in such a system. Accordingly, the dynamic stability is analyzed on the basis of available data on arenaceous soils and on cavitation under impact of waves. The filterless design of a protective retaining wall is still found satisfactory, for dams and dikes on medium-grain and coarse-grain foundations with a relative density D = 0.4-0.5, while in the case of fine-grain or argillaceous soils it is necessary to lay filters of mineral-fibrous detritus material in accordance with the All-Union Standard 33-10-73. The economic advantages of filterless retaining walls make further research on their overall application imperative. Figures 2; references 14 (Russian).

EXPERIMENTAL STUDY OF THE FLOW OF AN INCOMPRESSIBLE FLUID BETWEEN TWO ROTATING DISKS

MISYURA, V. I., Dnepropetrovsk State University

[Abstract] Satisfactory agreement with the author's earlier theoretical findings (IZV. AN SSSR, MEKHANIKA ZHIDKOSTI I GAZA No 5, 1972) is obtained here in an experimental study of the steady-state laminar flow of a viscous incompressible fluid from the center to the periphery in the gap between two parallel disks rotating uniformly in one direction with identical angular velocity. An optical anemometer was devised on the basis of the Mir-1M microscope, with a quadrangular mirror-prism as the reflecting surface, whose rotation angle was measured by electric signal and whose rotation rate was measured by an FD-1 photoelectric pickup with signal output to a ChZ-33 frequency meter. Assuming the flow to be two-dimensional, the author determined the field of velocities in the gap between the disks for various values of the basic parameters: flow rate, viscosity, angular rate of rotation, gap width, and disk radius. Velocity curves were plotted against dimensionless complexes K, Λ, and r, composed of the basic parameters. The same graphs show the author's earlier theoretical velocity profiles for comparison. For narrow gaps between the disks and high viscosity of the fluid the theoretical

relationships are in satisfactory agreement with the experimental and may be used in the development of the theory of disk pumps with effective energy exchange between the flow and the disks. The same formulas can be used to compute other hydraulic devices containing rotating disk pairs. Illustrations 4; Bibliographies 5: 4 Russian, 1 Western.

USSR   UDC 621.007.52

KINEMATIC STRUCTURE OF INDUSTRIAL ROBOTS

PAVLENKO, I. I.

[Abstract] Industrial robots are characterized by highly mobile limbs. In
order to facilitate the selection of the proper kinematic design for any
given application, all the many possible degrees of freedom are grouped on a
functional basis relative to any particular limb. A kinematic structure is
thus developed with effectively fewer degrees of freedom and corresponding
equations which relate the total degrees of freedom of a robot to the degrees
of freedom of each element and indicate the coupling between elements. The
use of such structural formulas for the analysis of robot kinematics is
demonstrated here on the simple case of one hand and one wrist as well as on
several somewhat more complex schemes. Figures 2; references 3 (Russian).

USSR   UDC 621.774.72

A METHOD OF SQUEEZING THE ENDS OF TUBULAR BILLETS

ZHVIK, I. M., and SMIRNOV, V. YE.

[Text] A device for squeezing the ends of tubular billets in a movable die
with bilateral support by means of a mandrel and a yoke, both axially movable,
with the distinguishing feature that, for increasing the degree of deforma-
tion during a single pass and for producing stock with a large taper, during
the initial stage of the process the free end of a billet is squeezed to a
degree of deformation close to the maximum allowable, within 15-20%, and the
deformation of this billet is then continued in the mandrel driven in the
direction of the die movement at a velocity higher than the die velocity,
namely

$$V_2 = V_1 \left[1 + \frac{2S}{D\sqrt{K}(1 + \sqrt{K})}\right],$$

where V_2 is the mandrel velocity,
      V_1 is the die velocity,
      S is the wall thickness of the billet,
      D is the outside diameter of the billet,
and   K is the reduction factor.

TECHNOLOGY FOR SANDWICH WALL PANELS AT THE VORONEZH ALUMINUM BUILDING STRUC-
TURES PLANT

MAYZEL', I. L., Candidate of Technical Sciences, KALININ, V. I., Engineer,
All-Union Scientific Research and Planning Institute of Heat Engineering
Structures; DMITRIYEV, S. K., Engineer, and KONOVALOV, G. I., VORONEZH
Aluminum Building Structures Plant

[Abstract] In 1974 the VORONEZH plant put into operation the first USSR shop
for the production of wall panels of shaped aluminum sheet with stiff polyure-
thane foam filler with an output capacity of 500,000 m^2 per year. The shop
was set up to produce flat wall panels 7,200 x 1,016 mm in 50-mm and 80-mm
thicknesses, as well as the corner panels. AMg-2M aluminum alloy is used as
the outer shell, and East German Sispur-4055 polyurethane foam (delivered as
two liquids to be mixed) is used as the filler. Concentrated 88N adhesive
is diluted with a mixture of ethyl acetate and benzine in a ratio of 2:1 by
weight. Tests showed that the working concentration should have a viscosity
of 20-25 s on the VZ-4 viscosity meter. The adhesive is sprayed on the alumi-
num shell and air-dried at 40-60°C. Foam thickness-stubs are attached by ad-
hesive to the top aluminum sheet. The metal is pressurized in stages and
then shaped (longitudinally ribbed) and filled in compression molds. The
ends of the panels are hinged and have holes for the insertion of the foam
and escape of air and gases. The corner pieces are first bent 90° and then
assembled and filled. The foaming-setting cycle in the compression molds
averages 30 minutes. Figures 2.

IMPROVING THE QUALITY OF FORGINGS PRODUCED BY EXTRUSION

ATROSHENKO, A. P., and FEDEROV, V. I.

[Abstract] Extruded forgings of the tough steels and alloys EI811, EI878,
EI961, EI437BU, Kh18N9T, and 2Kh13 are made from circular or rectangular
blanks, cut to size and surface finished to at least ▽ 5. Since experience
in extrusion forging of these special steels and alloys shows that the me-
chanical treatment of blanks with surface condition less than ▽ 5 impairs
the surface quality of the forging, in some cases the initial blanks are not
subjected to mechanical treatment. Large (over 60-mm dia) forgings of the
tough steels EI811, EI878, and EI961 have, as a result of shallow surface-
finish, a large number of defects that appear in the bar surface during
rolling. In female dies variously shaped forgings develop creases and

constrictions as a result of the opposite flow of the metal. Surface cracks always appear in forgings where hairline cracks were present in the initial blanks. Defects can be avoided by reconfiguring the dies; increasing the radii of transition on the mating surfaces; making the derivation not less than 10-20° on the horizontal surfaces, and the cone greater than 30° at the entrance to the die aperature; as well as by improving the quality of worker performance in the handling of the dies. Heating the dies during the extrusion of forgings of the tough steels and alloys EI437BU, EP105, EI435, EP648, slow cooling of forgings of steels 2Kh13, 9Kh18 in special cans or warm sand, and preliminary high-temperature annelaing and stress relieving of 2Kh13 and 9Kh18 forgings will prevent the formation of surface cracks and produce higher quality forgings. Figures 6; table 1.

RELIABILITY CHARACTERISTICS AND EFFECTIVENESS OF ACTION OF AN OPERATOR IN CONTROLLING POWER EQUIPMENT IN MANIPULABLE MODES

FEDOTOV, D. K., RINKUS, E. K., and MELITSKIY, YU. N.

[Abstract] On the assumption that one main reason for the difficulty in introducing automatic control systems into thermal electric power plants is the insufficient treatment of the problems of operator-equipment interaction, the authors derive numerical values of characteristics for the quality (mathematical expectation) of operator action with respect to time; probability of faultless execution of manipulable modes; probability of timely execution of a mode; and for efficiency with respect to annual labor expenditure for executing the modes; number of modes per year involving errors during the mode executions; annual number of untimely executed modes; and number of dangerous errors in mode executions. On the basis of these characteristics it is possible to obtain a qualitative estimation and comparison of variant executions of manipulable modes of operation of an automatic control system in power equipment (turbines and boilers). The experimental study of the actions of human operators in the start-stop modes shows that it takes an operator 20 minutes to stop the TP-10 boiler for a 6-8-hour reserve period and 70 min to start it and bring it to full load; here the probability of faultless execution is approximately 0.1, and the probability of timely execution 0.5. For the K-100-90 turbine the stopping time is 30 min, start-up time 65 min, probability of faultless execution is zero, and of timely execution 0.5. If, in place of the start-stop operator modes, a shift of the equipment into a "microload" (and withdrawal from it) for boilers and into a reduced rpm mode (and withdrawal from it) for turbines is used, the above ratings become, respectively, for the boiler: 13 and 10 min; 0.6 and 1.0; for the turbine 23 and 18 min; 0.15 and 1.0. Thus the introduction of the proposed new technology of continuous minimum load, rather than start-stop, greatly increases the possibility of manipulability of the operation of power equipment, and

at the same time reduces the number of equipment shut-downs by 0.2 per year per set, or prevents approximately two accidents (or breakdowns) because of human error at a thermal electric power station. Table 1; references 4 (Russian).

USSR   UDC 536.24:621.564.22

STUDY OF HEAT EXCHANGE DURING BOILING OF AMMONIA IN A PLATE AND RIB EVAPORATOR

Moscow KHOLODIL'NAYA TEKHNIKA in Russian No 8, 1977 pp 28-31

SHIKHOV, G. L., Angara Meat Packing Plant

[Abstract] This article reports a pilot-scale test of the heat exchange characteristics achieved upon boiling of ammonia in an evaporator equipped with welded sheet-rib surfaces. The influence of design parameters of the heat exchanger surface on the intensity of heat transmission in the apparatus was tested. The design of the apparatus is intended to allow maximum mechanization of its manufacture, thus reducing the cost of each square meter of heat exchange surface. The experiments were performed at boiling temperatures of 0 and -10 C. The study showed the economic effectiveness of the use of ammonia evaporators with plate and rib evaporators. Figures 4; references 8 (Russian).

USSR   UDC 629.113:621.78

ELECTROTHERMAL TREATMENT OF MODEL ZIL-130 CRANKCASES FOR AUTOMOBILE DRIVE AXLES

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 8, Aug 77 pp 29-30

OGNEVSKIY, V. A., OSTROVSKIY, G. A., RYSKIND, A. M., and SHKLYAROV, I. N., Moscow Automobile Factory imeni I. A. Likhachev

[Abstract] A new method of hardening the crankcase on the drive axle of an automobile has been introduced at the Sverdlovsk Plant. This method not only improves the operational reliability of crankcases, but also makes it feasible to produce them with easier processable and less costly materials. The entire treatment consists of six operations, which include local heating by induction, fast quenching in water, normalization, high-temperature temper, and case hardening. Grade 17GS steel, normalized for higher strength, is suitable for shafts and grade 35 steel is sufficiently crack-resistant for trunnions. Appreciable hardness is required, for producing residual

compressive stresses in the chamber so as to prevent fatigue fracture. The routing and transport of parts have been streamlined, the apparatus has been designed and laid out, all for implementing this new technique with maximum efficiency. The basis mechanical characteristics (static strength, life under fatigue loads, and wear resistance) of parts produced by this new method are much better than those made of grade 40-"select" steel by the old method. Figures 3; table 1; references 2 (Russian).

TECHNOLOGY OF SOLDERING OF THE DRIVE WHEELS OF COMPRESSORS MADE OF VT6S TITANIUM ALLOY

BESEDNYY, V. N., and CHERNOV, V. YU.

[Abstract] The National Scientific Research Institute for Compressor Machine Building has studied several versions of technology of soldering of VT6S titanium alloy in order to select the optimal version for the manufacture of centrifugal compressor wheels. The optimal version is found to be contact-reactive soldering using palladium, which produces a high strength joint without brittle layers. According to the technology, the palladium is applied by spot welding, then the wheels are soldered in vacuum furnaces at $1 \cdot 10^{-4}$ mmHg and 1160 C for 15 minutes. Heating is at not over 10 C/min to avoid thermal stresses. Industrial testing of the technology in the manufacture of centrifugal compressors has shown it to be highly reliable. Figures 4; tables 2.

CHOICE OF A PROGRAM FOR REGULATING HEAVY POWER BLOCKS IN ATOMIC ELECTRIC
POWER PLANTS

IVANOV, V. A., BOROVKOV, V. M., SLESARENKO, V. V., and KULIKOVA, G. G.,
Leningrad

[Abstract] An analysis of daily and weekly load curves indicates that adjust-
ing to a variable demand for electric energy in heavily populated and indus-
trialized regions of the country is still the most difficult aspect of power
management in the Soviet Union. With the ever increasing use of atomic and
thermonuclear energy for electric power generation, the problem of regulating
for peak and light loads as well as providing standby power during failures
becomes a very urgent one, especially where reactors run on thermal neutrons.
An algorithm has been developed at the Leningrad Polytechnic Institute imeni
M. I. Kalinin for calculating, on an ODRA-1204 digital computer, the thermal
performance characteristics and the technico-economic indicators of heavy
turbogenerator sets in atomic electric power plants, as a basis for program-
ming the complete regulation system. Such a program is found to be more
economical and reliable with a sliding rather than a constant pressure. Fig-
ures 4; table 1; references 11 (Russian).

CONTROL SYSTEMS IN ROBOT TECHNOLOGY

POPOV, YE. P., N. E. Bauman Higher Technical School, Moscow

[Abstract] The areas of application of robot technology will soon be as
broad as the areas of application of existing traditional means of automa-
tion. This article suggests a classification of manipulation-type robots,
a term which the author prefers over robot-manipulators. They are classi-
fied into automatic, bionic and interactive types, and definitions and struc-
tures are presented for all three types. The hierarchical structure of con-
trol systems used in these robots is outlined and briefly explained. In
general, the problem of development of robot technology is a complex scien-
tific and technical problem of great social significance, involving not only
the creation of robot systems, but also the development of principles of
their utilization in various branches of the national economy in combination
and close interaction with other types of mechanization and automation equip-
ment. Figures 3; references 12 (Russian).

VIBRATION ELECTRIC-DIAMOND GRINDING OF HARD ALLOY

TERESHCHENKO, L. M., and RAGOMIR, V. V.

[Abstract] Experiments have been conducted at the N. E. Bauman Higher Technical School in Moscow on the influence of audio frequency vibrations on the process of electric-diamond grinding of T15K6 hard alloy. The surface being worked was vibrated using a hydraulic vibrator consisting of a piston, valve device and DC electric motor driving an oil pump, forcing oil through the rotating valve. The valve has 20 radio apertures, producing 20 vibrations of the piston per rotation of the valve, which was rotated at 300-3,000 rpm, corresponding to 100 to 1,000 Hz vibration frequency. A significant decrease in the consumption of diamonds was noted as the vibrating frequency was increased, which is explained by the change in the kinematics of the process, conditions of contact of the grains of the disc and the blank being worked. Identical hydrodynamic working conditions are also created and evacuation of the reaction products from the zone of processing is improved. Figures 3.

STUDY OF THE KINEMATIC STATE OF VISCOUS-PLASTIC FLOW BY THE METHOD OF FINITE ELEMENTS

SEGAL, V. M., and SVIRID, G. P., Institute of Physics and Technology, Academy of Sciences BSSR, Minsk

[Abstract] A study is made of the flow of a viscous-plastic medium. It is assumed that the viscous-plastic medium is incompressible. The kinematic state of the viscous-plastic flow is studied on the basis of variational principles of the mechanics of continuous media. The solution is found by introduction of a regularizing functional, which applies the condition of incompressibility to the velocity field. As an example, the solution is presented to the problem of drawing of a bar through smooth and rough conical dies. Figures 4; references 9 (Russian).

DETERMINATION OF THE PERMISSIBLE MASS OF AIR CONDITIONING INSTALLATIONS FOR HYDROFOIL VESSELS

PATLAYCHUK, N. I., BRISHNIKOV, B. I., and KHOMULENKO, A. P.

[Abstract] In planning air conditioning installations for hydrofoil vessels, two contradictory problems arise: on the one hand, high productivity of the installations is required, while on the other hand the desire to increase the useful payload of the vessel requires that the mass and volume of the air conditioning installation be minimized. The permissible mass of an air conditioning installation including the supporting equipment it requires can be estimated in relationship to the displacement of the ship, power of the main engines, fuel reserve, speed and desired operating range by formulas presented in this article. Figures 2; references 5 (Russian).

SOME FEATURES OF WATER-JET PROPELLERS

MAVLYUDOV, M. A., and RUSETSKIY, A. A.

[Abstract] Water-jet propellers are generally used on vessels to be operated in shallow water, and in recent years increasingly in high performance vessels. This article analyzes some of the hydrodynamic and design peculiarities of water jets allowing them to compete with other types of propellers, particularly traditional screws. Shapes of water intake pipes, variation in propeller thrust with rotating speed and ejection of the water jet above or below the water line are analyzed. The conclusions drawn are primarily applicable to high speed ships. Figures 6; references 2 (Russian).

CALCULATION OF THERMAL STRESSES OF SHIP DECKING

SOLDATOV, N. P.

[Abstract] This article presents a method for determination of thermal stresses in ship decking; the calculation can be reduced to calculation of hydrostatic pressure using tables of supplementary functions taken from the reference literature. The full displacement of the decking is considered to consist of that calculated on the assumption that the beams operate independently plus the additional displacement arising as a result of the influence of reactions defined from the deformation compatibility conditions. Tables presented in the article demonstrate that local thermal bending leads to additional loading of the sections and significant redistribution of stresses. It is calculated that the thermal stresses in the hull of a tanker may approach the yield point of the steel of which the hull is made. When heating of petroleum products carried in the tanker is begun 2 to 3 days before arrival at port and the thermal stresses are therefore added to wave stresses, the result may be loss of stability and a reduction in the fatigue strength of structural elements of the ship.

KINEMATIC METHOD OF HULL SURFACE GENERATION USING SECOND ORDER CURVES
(DISCUSSION)

BALITSKAYA, YE. O., MARAYEVA, I. B., PERVOV, V. A., and FAYZULIN, D. G.

[Abstract] Analytical generation of hull surface curves utilizes several types of smooth curves of second order. The type of curve used to assign the line of the ship's surface which is then used to generate the hull surface by advancing it from section to section with constant modification according to the equation used determines the name of the corresponding kinematic method. For example, the method based on the use of quadratic parabolas is called the parabolographic method. The basic assumptions of the kinematic method based on the use of general second order curves are presented. Five boundary conditions must be assigned to define the coefficients of the equation for each section. According to the method suggested, the parametric curves are generated analytically by means of the second order equations used. The data on each parametric curve are recorded on computer tape and used to generate hull projections; the method is suitable for fairing and matching of sections of ships of various types. The set of routines used to run the method not only constructs a mathematical model of the

surface of the ship, but also solves a number of practical problems related to computer generation and printout of a portion of the technical documentation needed to prepare for construction of the ship. Figures 2; table 1; references 3 (Russian).

USSR   UDC   629.12.001.11:539.433

SELECTION OF DIMENSIONS OF THE FINITE ELEMENT IN SHIP HULL STRUCTURE VIBRATION CALCULATIONS

Leningrad SUDOSTROYENIYE in Russian No 6, Jun 77 pp 11-12

POLYAKOV, V. I.

[Abstract] The method of finite elements is widely used in strength calculations related to shipbuilding. A criterion is formulated in this article for the selection of the dimensions of the finite element based on comparison of the base resonant frequency of the finite element and the frequencies of perturbing forces or limits of the spectrum of the natural frequencies of the system. A criterion is developed which defines the area of base frequency of the finite element within which the error in determination of the amplitudes of forced vibrations is relatively small (2-3%). Figures 2; references 2 (Russian).

USSR   UDC   621.12-192

DETERMINATION OF DURABILITY AND RELIABILITY INDICATORS OF MARINE EQUIPMENT

Moscow NADEZHNOST' I KONTROL' KACHESTVA in Russian No 9, Sep 77 pp 14-20

YEFREMOV, L. V.

[Abstract] Two groups of failures are analyzed in order to calculate the basic reliability indicators: the first includes failures which actually occur during the period between routine maintenance operations and actually cause unplanned down-time of equipment; the second group includes failures which might occur with further operation of equipment as it reaches its limiting state, but are detected during planned maintenance cycles. Based on this subdivision, a method of calculation of assigned operating life remaining to failure using the gamma % life of each component part of a product operated using a planned preventive maintenance system is generated. It is suggested that the gamma % life remaining be calculated using a log-normal distribution rule. The basic assumptions used in calculation of permissible values of the availability factor of products are presented. The

methodological principles analyzed are used not only for determination of reliability indicators on the basis of observed results, but also in the development of requirements for assurance of reliability in the stage of planning of marine machinery. Figure 1; references 3 (Russian).

USSR   UDC 677.06:621

A PROMISING REINFORCEMENT MATERIAL FOR ALUMINUM-STEEL COMPOSITORS PRODUCED
BY THE LIQUID-PHASE METHOD

SEMENOV, B. I., TISHCHENKOVA, YE. F., KHANIN, YE. I., and CHUSOV, A. G.,
Moscow Higher Technical School imeni N. E. Bauman

[Abstract] Wire of corrosion-resistant grade VNS-9 (14.6% Cr - 6.5% Ni -
2.9% Mo) steel is recommended for fiber reinforcing an aluminum matrix. The
feasibility of economically producing such a composite material by impregna-
tion of wire bundles with liquid aluminum in a continuous casting process
has been established in laboratory experiments. A contact time of 0.5-1.0 s
in a bath at 660-680°C was found to yield the optimum result, softening the
steel by not more than 10%. Mechanical tests have revealed a correspondence
between the original tensile strength of steel wire and the final strength
of composite rope. Therefore, further improvements in the technology should
make it possible to produce a material with an ultimate strength above 40 MN/
m^2. Figures 3; tables 3; references 7: 3 Russian, 4 Western.

USSR   UDC 669.28: 539.42

STATISTICAL DESCRIPTION OF THE MICROCRACKS THAT DEVELOP DURING THE VISCOUS
FRACTURE OF MOLYBDENUM

RYBIN, V. V., and VERGAZOV, A. N.

[Abstract] Since the experimental data presently available in the literature
on the initial stages of crack generation during viscous fracture and conclu-
sions regarding the basis for the phenomenon are equivocal, the authors em-
ployed electron microscopy methods to find the distribution functions of micro-
cracks with respect to dimensions, orientation, strain rate and external pres-
sure on the fracture surface, outsides and interior of specimens of 99.9%
pure molybdenum fractured by uniaxial tension at $2 \cdot 10^{-3} sec^{-1}$ and T=373K
(corresponding to the crest of the cold-shortness curve). Both emission
(JEM-200A) and scanning (JSM-2) electron microscopes were used. The total
plastic deformation of the bars from which the cylindrical specimens were
prepared amounted to 75%. Before the mechanical testing, the molybdenum had
a subgranular structure. It was found that just before fracture occurs the
microcracks form on both sides of the fracture faces of the fragments and
open up along the edges, primarily under the influence of internal tensile

stresses. The time of formation of the microcracks amounts to 0.05 - 0.1 of the total time of deformation. Figures 3; references 12: 11 Russian, 1 Western.

STRUCTURE AND PROPERTIES OF THE METAL OF AN EI756 STEEL STEAM PIPE AFTER LONG USE

VERNER, M. A., and DRUZHININA, L. P., Ural Branch, State Trust for Organization and Improvement of Regional Electric Power Plants and Networks (ORGRES)

[Abstract] Results are given of an examination of the metal of 219 x 32-mm EI756 steel steam pipes after 55,500 hours of use. Data are also given on the increase of residual deformations after 65,422 hours, as well as, for the purpose of comparison, corresponding characteristics of the metal in the delivery condition and after 20,000 hours of use. The pipes were produced at the Southern Pipe and Metallurgical Plant, where they were normalized at 1,020-1,050°C, then annealed at 700-730°C for three hours and cooled in air. The short-time and long-time strength and plastic properties were still within the technical requirements at delivery and still guaranteed the normal safety factor with respect to strength. Steel EI756 is sufficiently strengthened as a result of the dispersion hardening and precipitation in the initial period of use of the secondary phases, carbides and intermetallide, to sustain the strengthening effect over long periods of use. Substitution of EI756 steel for the presently used perlite steel 15Kh1M1F could bring a reduction of the number of main steam pipes and of the wall thickness of such pipes, which would be an economic advantage. Figures 5; references 6 (Russian).

USE OF NEW TOOL MATERIALS IN GEAR-CUTTING HEADS

SILKIN, V. P.

[Abstract] Because, for the most part, only two steels (R9 and R18) have been used for gear-cutting heads, and research on other high-speed steels and cutting alloys has been insufficient, the author investigated the gear-cutting properties of steels R9K10, R14F4, R9M4K8, R9M3K6S, and R12F2K8M3, and cutting alloys T14K8, VK6M, TT20K9, and TT10K8B. For the tests, wheels were prepared with 5-6-mm modulus and 45° initial cone angle and 228.6-mm diameter

gear-cutting heads. The work was steel 40Kh (HB 185-200). The study considered the cutting speed, rate of feed, tangential, axial, and radial components of cutting force, wear, and the thermal emf of the natural thermocouple made up of the materials of the tool and work. The author found that the highest productivity (highest cutting rate) was obtained with cutting heads of the high-speed steels R9M4K8 and R12F2K8M3 and with the cutting alloys TT20K9 and T14K8, the latter providing at least twice the productivity of traditional cutting heads with steel R18. In the case of steel R12F2K8M3 the ideal cutting speed was 50-55 m/min, above which the tooth wear increased unfavorably and became "catastrophic" after three minutes of operation at 96 m/min. With the T14K8 alloy the maximum wear occurred at cutting speeds of approximately 100 m/min. Illustrations 5; Bibliographies 2 (Russian).

USSR   UDC   621.791.053.001.5 : 669.245

LIQUATION OF NIOBIUM AND ALUMINUM IN WELDS OF NICKEL ALLOYS

BULATOV, YU. V., and LOSEVA, G. I.

[Abstract] In the study of the liquation of niobium and aluminum as alloying elements in stainless nickel alloys, binary solid solutions of nickel with aluminum and niobium are considered here because of their narrow crystallization range, which increases the probability of hot cracking in the solid state. In the nickel solutions with low (3% at) concentrations of the alloying element the niobium influences the reduction of the critical rate of deformation more strongly than does aluminum, and in solutions of higher concentrations causes practically no change of the resistance to hot cracking. This may be explained by the fact that as a result of the considerable boundary segregation of the niobium the solutions of such concentrations are not monophase, and the Ni_3Nb phase can form at the grain boundaries, thus the hot cracking is caused by a different mechanism. The very slight influence of the niobium on the resistance to hot cracking does not put a limit on its content in the alloys (within its limit of solubility in nickel). Since the aluminum in the binary solid solutions of nickel considerably reduces the critical rate of deformation its content in the solutions must be limited to 11% (at). Illustrations 5; Tables 2; Bibliographies 10.

INFLUENCE OF HEAT TREATMENT ON THE PROPERTY AND STRUCTURE OF WELDED JOINTS OF AN ALLOY OF THE SYSTEM Al-30Be-5Mg

KOMAROV, M. A., LOBZHANIDZE, A. V., SMIRNOVA, A. I., and GITARSKIY, L. S.

[Abstract] An earlier work by Komarov and Lobzhanidze (Fizika I Khimiya Obrabotki Materialov No 3, 1972 p 91) reported on the structural inhomogeneity and nonequilibrium condition in the weld and area of thermal effect of welded joints of an alloy of this system. Earlier, Fridlyander (Metallovedeniye I Termicheskaya Obrabotka Metallov No 7, 1970 p 50) showed that the metastable state of the metal can cause great changes in the corrosion resistance of the metal during ageing and heating during use. The present work studies the properties, structure, and phase condition of compounds of the system Al-30Be-5Mg obtained by arc welding in a controlled argon atmosphere with a non-consumable tungsten electrode without filler.

It was found that the metal of the weld and heat-effected area after welding is metastable and prone to ageing in the temperature range 100-300°C with the separation of intermetallic Mg_2Al_3. In this case the impact toughness is reduced. Annealing the welded joints at 500°C for 2 hr enhances the ductility and structural stability of the weld metal without impairing the properties of the base metals. Illustrations 2; Tables 2; Bibliographies 2.

DISTRIBUTION OF ELEMENTS IN THE SURFACE LAYERS DURING ELECTROSPARK ALLOYING

LAZERENKO, B. R., MIKHAYLOV, V. V., GITLEVICH, A. YE., VERKHOTUROV, A. D., and ANFIMOV, I. S.

[Abstract] A study is made of the distribution of the elements and phase composition in the surface layers of VT1 and VT6 titanium alloys that are electrospark alloyed with aluminum, chromium and the iron-group metals Fe, Co, Ni as well as the case of electrodeposition of chromium, aluminum and nichrome Kh20N80 on iron and Steel 45. It is shown that in electrospark welding the surface layer of the cathode is formed by a mechanical mixing of the electrode materials, their interaction with the generated solid solutions and intermetallides and the diffusive interpenetration in both the liquid and solid phases. It was found in the case of the VT1 specimens that thermodiffusion annealing at 800-1200°C for 1-2 hours leads to a deep (400-800 microns and over) penetration of chromium, iron, cobalt and nickel into the substrate.

In layers formed by electrospark alloying the presence of cathode material as well as anode material is particularly pronounced in the treatment of titanium and its alloys when the amount of titanium in the formed surface layer can amount to 60-70%. Illustrations 5; Bibliographies 17.

INFLUENCE OF ALLOYING OF AUSTENITIC STEELS WITH MANGANESE AND NITROGEN ON ISOTHERMAL AGING PROCESSES

SIMONOVA, T. N., ALEKSEYEVA, L. YE., and USOVA, L. F.

[Abstract] The method of internal friction with a frequency of forced pendulum oscillations of 1 Hz, specimens 0.8 mm in diameter and 80 mm long, was used to study the temperature variation of internal friction in the annealed state and in the state after isothermal aging at 750 C for 15 minutes to 50 hours. X-ray structural analysis was also used to determine the change in lattice parameter of the austenite and the width of the (311) interference line in the process of aging, and a photographic method was used to study the composition of second phase precipitate separated in the process of aging. It was found that combined alloying of austenitic steels with manganese and nitrogen is promising both from the standpoint of replacement of expensive and scarce nickel in chrome-containing alloys, and from the standpoint of increasing their strength and corrosion resistance. Figures 5; references 6 (Russian).

STUDY OF THE EFFECTIVENESS OF PISTON RINGS OF F4-G10 GRAPHITE-FLUOROPLASTIC MATERIAL

ABBASOV, A. M.

[Abstract] This article reports on tests of oil-field compressors with piston rings made of F4-G10, a graphite-fluoroplastic material. Oil field testing showed that piston rings of F4-G10 had an operating life of 1,500 hours, whereas bronze piston rings have lives of not over 1,000 hours under similar

conditions. No cylinder wall wear was detected. Thus, F4-G10 is a suitable material for piston rings for use in high pressure oil field compressors, achieving an economic effect not only due to the increased durability of the rings, but also due to the significant increase in durability of cylinder linings and the elimination of the need to lubricate the cylinders, since the material is self-lubricating.

STRUCTURE AND MECHANICAL PROPERTIES OF A SHEET OF TYPE OKh14AG12M CAVITATION RESISTANT STEEL

BUGACHEV, I. N., and RUDAKOV, A. A., Urals Polytechnical Institute

[Abstract] A 40 ton commercial melt of type OKh14AG12M hot-rolled sheet steel was produced to clad the cavitating surface of hydraulic turbine blades by explosive welding. The mechanical properties, structure, cavitation resistance, weldability and impact toughness of the steel were studied after various heat treatment loads. It was found that type OKh14AG12M sheet steel has a good combination of mechanical properties, cavitation resistance and weldability and can be used for cladding of blades by explosive welding. Final tempering should be performed at higher temperatures when this material is used--750-850 C. Table 1.

STRUCTURE AND PROPERTIES OF CAST HEAT RESISTANT COMPOSITE CONSISTING OF NICKEL ALLOY PLUS TUNGSTEN WIRE

BANAS, F. P., LUDNIK, G. I., MYAL'NITSA, G. F., NATAPOV, B. S., LEVIN, YE. YE., and RYBNIKOV, A. I., Mechanical Products Plant imeni V. Ya. Chubar'; Scientific and Production Union for the Study and Planning of Power Equipment

[Abstract] The purpose of this work was to produce reinforced parts of complex configuration, for example, turbine blades by free casting of a nickel-chrome alloy containing tungsten and molybdenum wires and subsequent extrusion of the ingot and to study the behavior of the molybdenum and tungsten wires during formation of the composite. The reinforced material was made of type KhN60VMKTBYu chrome-nickel alloy reinforced with type VMZP molybdenum

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wires 500 µm in diameter, both without coatings and with a tungsten coating 15-20 µm thick and W wires type VT-10. The method of precision casting by investment allowed the production of experimental blades 80 mm in length with tungsten reinforcement of satisfactory quality. Further work is needed to improve the technology of production of larger products. Molybdenum alloy wires, with high reactivity in the matrix solution, are dissolved rapidly. The wires which survive are significantly recrystallized and form an inter-metallic phase at the boundary with the matrix. A layer of W on the molybdenum wires prevents recrystallization, although it is penetrated by the elements of the matrix, which then form an intermetallic layer beneath the tungsten layer. W wires are considerably more resistant to dissolution in nickel-chromium matrices, and the long-term strength of the W reinforced composite material was found to be better than the best current-day heat-resistant alloys. Table 1; figures 4; references 4: 3 Russian, 1 Western.

HIGH-TEMPERATURE RADIATION CHARACTERISTICS OF CRYSTALLOGRAPHICALLY ORIENTED PYROLYTIC GRAPHITE

RUBTSOV, N. A., and TARASOV, A. G., Institute of Thermophysics, Siberian Branch of the Academy of Sciences USSR, Novosibirsk

[Abstract] The spectral emissivity of pyrolytic graphite at high tempera-tures is examined on the basis of an experimental study and fundamental laws. Graphite specimens 25x25x3 mm^3 in size were produced with the surface, either parallel or perpendicular to the deposition plane, subsequently ground and polished. A specimen was placed in the focus of a large elliptic mirror and heated there by an electric arc, while a reference lamp was placed in the focus of another large elliptic mirror. Measurements were made with a pyro-meter and a monochromator, through a system of a plane mirror, a shutter, and two periscopes. As a result of these measurements and subsequent calcu-lations, the emissivity of two principal graphite surfaces could be plotted as a function of the temperature at a constant wavelength and as a function of the wavelength at a constant temperature. These emissivity characteris-tics are evidently affected by the surface structure and thus by the heat treatment of graphite after the pyrolytic process. Figures 7; references 4: 3 Russian, 1 Western.

FORMATION OF COLD CRACKS DURING MULTILAYER WELDING

ALEKSEYEV, G. M., FEDOROV, V. G., MAKAROV, E. L., SHTRIKMAN, M. M., and
MILIYEVSKIY, R. A., N. E. Bauman Higher Technical School, Moscow

[Abstract] Conditions of manual argon-arc multilayer welding of steel type
08Kh15N5D2T are established, which may lead to the formation of cold cracks
in the welded joints. A method is developed for estimating the resistance
of this martensite-aging steel to the formation of cold cracks in multilayer
welding. The studies show that when welding wire of similar chemical composi-
tion is used, cold cracks may appear on the face portion of the seam, or in
the root zone of the seam after continuous welding. The crack formation zone
characteristically has intensively etched boundaries of the austenite grains,
with a local simultaneous increase in the content of C and Cr in the area of
these boundaries. It is probable that the embrittlement of the structure in
the fracture area is related to precipitation of chromium carbides. Multi-
layer welding with cooling of the seam to 30 C after each pass does not lead
to formation of cold cracks. Resistance to cold cracks can be increased by
using 03Kh11N10M2T wire. An increase in hydrogen content decreases cold
crack resistance of joints. Figures 2; references 2 (Russian).

STUDY OF THE FATIGUE STRENGTH CHARACTERISTICS OF TYPE OT4 TITANIUM ALLOY
CONSIDERING THE INFLUENCE OF STRESS CONCENTRATION

BOYTSOV, B. V., KRAVCHENKO, G. N., and IVANOV, A. L.

[Abstract] A method is presented for estimating the fatigue strength parame-
ters based on similarity equations, using type OT4 titanium alloy as an ex-
ample. The statistical parameters of the endurance limits of this material
are presented. Fatigue testing was performed on magnetic resonance installa-
tions with loading frequencies of 170 to 220 Hz depending on specimen type.
The specimens were loaded with alternating bending loads in one plane using
a symmetrical cycle with a test base of 10^6 cycles. Testing continued until
a crack 0.8-2.0 mm long appeared in the specimen. The scattering of endurance
limit of OT4 titanium alloy is greater than that of medium-strength steels.
Figures 4; tables 3; references 2 (Russian).

FORMATION OF MULTILAYER (α') AND DEFECT MARTENSITE PHASES IN COBALT-TITANIUM ALLOYS

NIKOLIN, B. I., Institute of Metal Physics, Academy of Sciences Uk SSR, Kiev

[Abstract] X-ray studies of Co-Ti, Co-Ni, Co-Mn, Co-W and Co-Mo single crystals were undertaken in order to determine the possibility of appearance of multilayer martensite phases in them. Attempts were made to detect multilayer and defect martensite phases in Co-Ni, Co-Mn, Co-Mo and Co-W alloys. It was found that in these systems after hardening and repeated ($\beta \lessgtr \alpha$) transition (up to 500 cycles), a hexagonal close packed lattice of α-martensite is formed with low chaotic packing defect density (less than 0.10), but neither multilayer nor defect structures arise. Analysis of the results produced indicates that multilayer and defect structures arise in binary cobalt alloys in which: 1) the solubility of the alloying element is low; and, 2) the martensite conversions occur at below-freezing temperatures.

USSR   UDC 621.384.2

A METHOD OF CONTINUOUS MEASUREMENT OF THE DISPERSE-PHASE AEROSOL CONCENTRATION

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 37, 5 Oct 77 Author's Certificate No 575547 11 May 76

NEYMAN, L. A., RUMYANTSEV, V. V., KOL'TSOV, B. YU., and TURUBAROV, V. I., Leningrad Institute of Aviation Instruments

[Text] A method of continuous measurement by first passing the stream of aerosol particles through the zone of a unipolar corona pulse-discharge and then measuring the charge induced by these particles on the instrument electrode, with the distinguishing feature that, for a higher measurement accuracy, the particles in the aerosol stream are precharged in the field of a d.c. corona discharge to a level above their intrinsic charge, the polarity of this d.c. corona discharge being opposite to the polarity of the corona pulse-discharge.

USSR   UDC 531.765

A METHOD OF DETERMINING THE NULL DRIFT OF AN ACCELEROMETER WITH A HYDRODYNAMIC SENSOR

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 37, 5 Oct 77 Author's Certificate No 575574 17 May 76

ABRAMOV, YU. A.

[Text] A method of determining the null drift of an accelerometer by measurement of the output signals at a constant acceleration, with the distinguishing feature that, for improving the accuracy, the accelerometer output signals are measured at two different angular velocities of the rotating sensor and then the null drift is calculated according to the formula

$$\Delta U_0 = \frac{1}{2}\left[(U_1 + U_2) - (U_1 - U_2)\left(\frac{\omega_2^2 + \omega_1^2}{\omega_2^2 - \omega_1^2}\right)\right]$$

where ω_1, ω_2 are the angular velocities
and U_1, U_2 are the corresponding magnitudes of the output signals.

AN ULTRASONIC METHOD OF CHECKING OUT LEVEL GAUGES

KHUSAINOV, B. G., TUPICHENKOV, A. A., and ANTONOV, N. N.

[Text] A method based on transmission and reception of ultrasonic waves for
establishing the presence of liquid within the test zone on the basis of a
change in the amplitude of such a wave at the receiver, by sending an ultra-
sonic wave into the wall of the liquid container parallel to the liquid sur-
face, within the zone of dangerous liquid level, the trail of this wave moving
along its entry surface at a velocity set equal to the velocity of a flexural
wave through the wall and the amplitude of this propagating ultrasonic wave
used as the information carrying signal, with the distinguishing feature that,
for improving the accuracy and reducing the variation of readings, into the
container wall above and below the test zone are also sent auxiliary flexural
waves countering the main flexural wave at equal distances from it, these
waves made to traverse a fixed path across the container wall, then converted
to electric signals, and from the latter control pulses are formed at the in-
stant of an amplitude jump which will suppress changes in the liquid level
upon its reaching the zone of propagation of the main flexural wave.

ANALYSIS OF SUPERSONIC STREAMS BY MEANS OF HOLOGRAPHIC INTERFEROMETRY

VLADIMIROV, A. S., GOLUBEV, B. V., LOVKOV, S. YA., OVECHKIN, A. P., POLYAYEV,
V. M., POMOGAYEV, F. F., and REVTOVICH, N. YA., Moscow Higher Technical
School imeni N. E. Bauman

[Abstract] The aerodynamic problem of supersonic flow past blunt bodies is
experimentally analyzed by various optical shadow or interference methods,
but holographic interferometry with a use of laser overcomes most difficulties
associated with tuning and precision as well as with large inhomogeneities
and density jumps in the medium. This technique has been applied to the an-
alysis of the flow pattern at Mach 6.0 past a permeable cylindrically blunted
wedge, pressure 3.1 MPa and temperature 490 K. The instrumentation consisted
essentially of a model IAB-451 shadowgraph, a main pulse laser (OGM-20 on the
wavelength λ = 0.69 μm, pulse energy 0.3 J, pulse width $2 \cdot 10^{-8}$ s) with a dia-
phragm for improving the space-time characteristics of the output radiation,
and an auxiliary He-Ne laser for adjusting the optical system. The density
distributions, with and without gas injection, are obtained from such

measurements, and subsequent calculations are done on the basis of gas-mechanical and geometrical relations. Figures 3; references 5: 3 Russian, 2 Western.

USSR   UDC 627.824.7.012.4:624.042.5

STATE OF THERMAL STRESS WITH CREEP IN CONCRETE BLOCKS FOR DAM STRUCTURES

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 9, Sep 77 pp 20-24

PLYAT, SH. N., and SHEYNKER, N. YA.

[Abstract] The state of stress in one large concrete block on an elastic-creeping foundation is determined by a method which also allows for creep in the block. The fundamental equations of thermoelasticity are first applied to a block on an elastic foundation, with the latter represented by a half-plane in the two-dimensional problem. The effect of creep on the thermal stresses is then accounted for, within some approximation, by influence factors. For a valid evaluation of the results obtained by this method, the calculations are shown for a zone of the block where application of the Arutyunyan principle would yield a sufficient engineering accuracy. Figures 3; tables 3; references 10 (Russian).

USSR   UDC 629.7.051

SYNTHESIS OF OPTIMAL CONTROL IN DISTRIBUTED SYSTEMS WITH INCOMPLETE MEASURE-MENTS

Kazan' IZVESTIYA VUZOV, AVIATSIONNAYA TEKHNIKA in Russian No 2, Apr/Jun 77 pp 45-49

DEGTYAREV, G. L., and SIRAZETDINOV, T. K.

[Abstract] A linear system is considered in a k-dimensional Euclidean space, including an n-dimensional state vector and a p-dimensional control vector. An m-dimensional signal, observable at individual but not all points, is re-lated to the state vector through a matrix function characterizing the method of measurement. The problem is to determine the control, a function of the output variables, which will minimize the characteristic functional. The structure of the regulator is found by dynamic programming on the basis of a complete measurement first and then, with the form of the minimizable func-tional appropriately stipulated and a constraint on the elements of the mea-surement matrix lifted, also on the basis of an incomplete measurement. The

now applied to the optimal control of a thermal boundary layer, namely determination of the optimum injection velocity for minimizing the heat transfer from a hot gas stream to a plate, and a solution is obtained in closed form without a degree of freedom in the boundary conditions. References 9: 7 Russian, 1 German, 1 Western.

AXISYMMETRIC TRANSIENT INTERACTION BETWEEN A SHOCK WAVE AND A BARRIER INSIDE A CYLINDRICAL PIPE

DUBROVSKAYA, L. I., and KOMAROVSKIY, L. V.

[Abstract] A cylindrical pipe is considered with a stationary or movable piston closing it at one end and the other end opening into a gas-filled space. A shock wave is generated either by motion of the piston or by rupture of a diaphragm located in any section along the pipe. The parameters of gas dynamics at any instant of time during the transient period are calculated by the finite-difference method of solving the equations of axisymmetric flow for a nonviscous and thermally nonconducting gas. The resulting one-dimensional Riemann problem is solved everywhere by iteration with exact formulas. In this way, velocity and pressure fields in the gas discharging at the open end can be determined at any given instant of time. Figures 3; references 8 (Russian).

EXPERIMENTAL STUDY OF THE EFFECTIVENESS OF A GASEOUS SHIELD IN A SUPERSONIC AXISYMMETRIC NOZZLE

VOLCHKOV, E. P., KOZ'MENKO, V. K., and LEBEDEV, V. P., Institute of Thermophysics, Siberian Branch of the Academy of Sciences USSR, Novosibirsk

[Abstract] A shield of cooling gas is often used as thermal protection of channel walls. Its effectiveness in an axisymmetric nozzle consisting of a subsonic convergent segment and a supersonic divergent segment was studied experimentally in a continuous-duty wind tunnel, with a main stream of air

results of this analysis are now applied to control optimization problems with the quality criterion defined at some instant of time and in a certain sense only. References 3 (Russian).

GENERALIZED ZONAL METHOD OF ANALYZING AND CALCULATING THE RADIATIVE HEAT TRANSFER IN AN ABSORBING AND SCATTERING MEDIUM

SURINOV, YU. A., Moscow Economics Statistics Institute

[Abstract] A generalized method of calculating the radiative heat transfer in an absorbing and scattering medium is shown which covers all eight basic formulations of the problem, each with differently stipulated boundary conditions and intrinsic field characteristics but each having a unique solution. This method is based on finite linear systems of algebraic equations approximating the system of integral equations with respect to the fundamental resolvent radiation characteristics. This method facilitates the calculation and numerical evaluation of local as well as mean (zonal) radiation characteristics, in accordance with two theorems pertaining to angular radiation coefficients and solid angles. Two versions of this method are given, both closely related but differing in the setup of the finite system of algebraic equations and in the procedure for their solution. References 6 (Russian).

DETERMINATION OF ECONOMIC LOSSES FROM INCORRECT MEASUREMENTS DURING COMPLETE VERIFICATION OF THE CONDITION OF THE METROLOGIC SERVICE

BESFAMIL'NAYA, L. V.

[Abstract] Basic models are suggested for determination of the losses resulting from incorrect measurements in order to determine the economic effectiveness of measures intended to increase the level of metrologic support of the production of high quality instruments. The primary principle is that economic analysis must consider the interests of the economy as a whole. This requires comprehensive consideration of the costs of measurements as

well as all economic results achieved by making the measurements. The second principle is that economic analysis and determination of the necessary initial data for calculation must agree strictly with the norms documents on reliability and quality control. The third principle is that the main factors and sources of economic losses due to incorrect measurements must be determined and classified before economic calculations are begun. The fourth principle and condition of objectivity is the use of the systems approach to analysis. The fifth principle is determination and distribution of the economic effect which arises among organizations directly participating in measurement. The sixth principle is that all initial data used for calculation of economic losses must be subject to comparison. References 3 (Russian).

SOME PRINCIPLES OF THE DESIGN AND PLANNING OF CONTROL DEVICES FOR AUTOMATED INDIRECT MEASUREMENT APPARATUS

MAKOVICH, A. A.

[Abstract] A process is suggested for development of automated apparatus for indirect measurements. The process is studied using the example of measurement of the activity of nucleides. Definitions, tables and formulas are presented which are necessary for the synthesis of finite automoton with their operation recorded in flow chart form. The principles presented for the design and planning of automated installations, developed for the measurement of ionizing radiation, can also be used for other types of indirect measurement. Figures 4; tables 3; references 11 (Russian).

USSR   UDC 549.355

GOLDFIELDITE FOUND FOR THE FIRST TIME IN THE USSR

TSEPIN, A. I., NOVGORODOVA, M. I., and DMITRIYEVA, M. T., Institute of Geology
of Ore Deposits, Petrography, Mineralogy and Geochemistry, Academy of Sciences
USSR, Moscow

[Abstract] Goldfieldite is a rare tellurium-containing mineral first dis-
covered in 1909. The authors have found this mineral in gold-sulfide-quartz
ores in a deposit in eastern Uzbekistan with the aid of an electronic micro-
probe. The chemical composition of the mineral was determined on a "cameca"
X-ray microanalyzer, and has an unusually high content of Te (23.06 - 24.09%)
plus Ag and Fe impurities. The studies of the Uzbek goldfieldite indicate
that it is a tellurium-containing variety of tetrahedrite, which should pro-
bably be acknowledged as an independent mineral type, with the same right to
separate recognition as tennantite (As-containing) and tetrahedrite (Sb-con-
taining) members of the same group of ores. Tables 2; references 14: 7
Russian, 7 Western.

USSR   UDC 622.271: 533.5

WAYS OF PERFECTING THE TECHNOLOGY OF MINING RAW GEM STONES

SMOLYANITSKIY, A. A., GENKIN, YE. YE., LUZIN, G. P., and GORELIK, M. L.

[Abstract] As a replacement for the more expensive manual, mechanical, and
blasting methods of getting raw gem stones the method of electrically exploded
wires in liquid to obtain raw gem stones of a limited size is investigated on
the basis of a laboratory electric pulse apparatus that provides a regulation
of the accumulated energy in two capacitors. The stand has an intake power
of 1.4 kw, 220/380-v feed, max energy of each capacitor 1,875 joule, and max
capacitor discharge time of 60 sec. Eight mineral rock types were used in
tests for the most advantageous discharge energies, wire diameters, spacings
etc. The method is shown to bring 25-27% savings in the cost of hacking gem
stones. Illustrations 1; tables 2; bibliographies 6.

UDC 550.834

DETERMINING THE POSITION OF A GASH LINE OF A REFLECTING LAYER BY THE METHOD OF SEISMIC ENSEMBLES

GURVICH, I. I., and ZAYDEL'SON, I. I.

[Abstract] In a study of the method of seismic ensembles in dynamic measurements in seismic prospecting the authors demonstrate the possibility, in principle, of employing the differential level factor L_k for studying the local properties of a reflective area in the case of a thin gash. This approach can also be used for other models of reflective area structure. The processing is subjected to the presence of considerable "noise," apparently from the relatively high values of σ_L^2 (mean square error of the L_k factor, which is shown to be proportional to the second derivative of the reflection factor). A reduction of this "noise" level will necessitate a refinement of both the seismogram model and of the technique and technology of registering and reproducing seismic recordings, particularly by a high-quality digital technique. The complete mastering of the spectral approach to the analysis of seismic data, on which the theory of seismic ensembles is based, is of particular importance. Illustrations 2; bibliographies 3.

UDC 552.323:551.72+(470.11)

FIRST FIND OF EFFUSIVES AMONG THE VENDA REDKINSKIY DEPOSITS OF THE NORTHERN RUSSIAN PLATFORM

STANKOVSKIY, A. F., VERICHEV, YE. M., KONSTANTINOV, YU. G., SKRIPNICHENKO, V. A., and YUZHAKOV, V. M., Arkhangel'sk Territorial Geological Administration

[Abstract] During a large-scale aeromagnetic survey of the western portion of the Onega Peninsula performed in 1971, a ΔTa anomaly was found near Lake Voyozero, extending in the submeridianal direction and measuring 3 x 0.45-0.8 km. Test drilling revealed a body of magmatic rock in the 154.6-220 m depth interval. The body consists of quartz dolerites of dark gray, almost black color with a greenish shade, fine and medium grained with a porphyry-like texture. The Voyozero quartz dolerite find is the first direct indication of existence in late Precambrian of yet another Redkinskiy stage of magmatism of platform type, related to crustal restructuring of the Russian Platform in the early Venda. Figures 2; table 1; references 7: 6 Russian, 1 Western.

Precision Optical & Mechanical

SOME SPECIAL FEATURES OF THE DESIGN OF A PHOTOELECTRIC TRACKING SYSTEM WITH
MIRROR-LENS REFLECTOR FOR MEASURING LINEAR TRANSLATIONS

KONONOV, A. V., Moscow Institute of Engineers of Geodesy, Aerial Photography
and Cartography

[Abstract] The author considers the possibility of designing a system without
scanning device. In this case the zone of observation and guidance zone co-
incide. Expressions derived in the study show that the system considered
here is equal to the systems that use the well-known trihedral reflectors.
Experimental work confirms the theory and shows the possibility of designing
photoelectric trackers with mirror-lens reflector that will provide high ac-
curacy in guidance (on the order of 30-10 seconds of arc). Such a system
should provide guidance and measurement within a wide range (several seconds
of arc) without the preparatory search and transfer to tracking, which es-
sentially simplifies the instrumentation aspects. Illustrations 2; bibli-
ographies 6.

LUMINESCENCE SPECTRA OF PHOTOGRAPHIC EMULSION MICROCRYSTALS WITH VARIOUS
FACETING CONFIGURATIONS

BELOUS, V. M., TOLSTOBROV, V. I., CHURASHOV, V. P., and SUVORIN, V. V., Sci-
entific Research Institute of Physics at the Odessa State University

[Abstract] Cold luminescence and faceting of AgBr(I) emulsion microcrystals
depend largely on the implanted iodide. In view of this, an experimental
study was made to determine the effect of the habitat on the luminescence
spectrum. On the basis of these measurements and earlier data, an increase
of the iodide concentration seems to produce a glow band with λ_{max}=536 nm,
but only at temperatures below 120 K, attributable not to single iodine ions
but to paired iodide centers. So is the green luminescence at 77 K, the lo-
cation of its peak on the spectrum depending on whether such a center falls on
the $\{100\}$ or on the $\{111\}$ face of a microcrystal. Figures 3; references 10:
5 Russian, 5 Western.

ELASTIC DISTORTION OF FAST-ROTATING PRISMATIC MIRRORS

TRACHUK, V. S., All-Union Scientific Research Institute of Opticophysical
Measurements

[Abstract] A higher rotational speed of the scanning mirror, up to or even
above $300 \cdot 10^3$ rpm, most effectively improves the time resolution of optico-
mechanical recording instruments. One problem in the development of such
ultrahigh-speed devices is the elastic distortion of the reflecting prism
faces due to fast rotation. This study deals with polyhedral mirrors used
for servomechanisms. The elastic strain due to fast rotation is calculated
here analytically, according to the fundamental equation in the theory of
elasticity in polar coordinates and with the appropriate boundary conditions.
The effect of rotor-mirror performance parameters and of material character-
istics on the distortion of reflecting surfaces is further analyzed. The
design is then optimized by proper matching of the cross-section geometry,
in terms of the number of prism faces, with the Poisson ratio of the prism
material. The practical limit on the maximum possible specific modulus of
elasticity E/ρ makes beryllium the most suitable material. Figures 6; table
1; references 8: 1 Russian, 1 German, 6 Western.

USSR   UDC   539.3

DEVELOPMENT OF STUDIES ON THE MECHANICS OF DEFORMATION AND FRACTURE

MAKHUTOV, N. A., RABOTNOV, YU. N., SERENSEN, S. V., and PRIGOROVSKIY, N. I., Moscow

[Abstract] A study is made of the problems of mechanics of deformation and fracture of homogeneous, heterogeneous and composite substances under various loading conditions in order to estimate the strength and operating life of structures. Methods are analyzed for calculation and experimental determination of the forces, displacements, deformations and stresses, as well as the equations of state and the fracture criterion as applicable to nuclear power structures. The mechanics of composite materials are related to the initial structure, anisotropy and dispersion of properties and defects in structures. The studies performed allow a description of the structure, texture and peculiarities of behavior under load of elements of new composite materials, such as carbon fibers, boron filaments, thread-like crystals, polymer and metal matrices, as well as the peculiarities of their interaction in composites in order to establish the optimal modes for manufacture, methods of reinforcement and achievement of maximum mechanical properties. The regularities of the processes of fracture and their relationship with the initial defect content of reinforced elements established are used as a basis for development of requirements for the quality of production of composite materials. Figures 10; references 38 (Russian).

USSR   UDC   534.1:531.8

INFLUENCE OF HIGH FREQUENCY EFFECTS ON CONDITIONS OF PARAMETRIC EXCITATION
OF MECHANISMS

VUL'FSON, I. I., Leningrad

[Abstract] This article is dedicated to the study of the problem of the influence of high frequency perturbations on parametric excitation of mechanisms, using available information on the dissipative properties of the mechanisms produced for the single-harmonic mode of oscillations. A study is made of the mechanism with a nonlinear position function, the support of which is acted upon by a high-frequency kinematic perturbation. It is found that the oscillating mode is stable if a transition is made from the area of instability to the area of asymptotic stability on the curve of λ_0 as a function of A, where λ_0 is the logarithmic decrement and A is the amplitude of the oscillations. Figures 6; references 6 (Russian).

USSR   UDC   533.6.013.42

UNSTABLE HYDROELASTIC OSCILLATIONS OF A THICK WALL SPHERE

GRIGOLYUK, E. I., GORSHKOV, A. G., and TARLAKOVSKIY, D. V., Institute of
Mechanics, Moscow State University

[Abstract] A study is made of a homogeneous, isotropic thick wall elastic
spherical shell with outside radius b and inside radius r. At the initial
moment in time the system is at rest, then an evenly distributed pressure is
applied to the outside surface. The inside surface is considered free of
stresses. The radial oscillations of the elastic sphere immersed in the
acoustical medium are studied as the pressure is suddenly applied to its out-
er surface. The nature of propagation of circular stress waves through the
thickness of the envelope is shown by curves in Figure 3. Figures 3; refer-
ences 7: 4 Russian, 3 Western.

USSR   UDC   539.371.6:669.017.3

ANOMALOUS ELASTICITY RESULTING FROM 2H $\leftrightarrows$ 6R LATTICE RESTRUCTURING UPON DE-
FORMATION OF COPPER-ALUMINUM-NICKEL ALLOYS

MARTYNOV, V. V., and KHANDROS, L. G., Institute of Metal Physics, Academy of
Sciences Uk SSR, Kiev

[Abstract] Anomalous elasticity, formerly reported upon formation of mar-
tensite in copper-aluminum-nickel alloys, also appears upon deformation in
the martensitic state, most clearly when the orientation of the tensile axis
is close to $[100]_{\beta 1}$. An X-ray study is undertaken in order to determine the
nature of the phase formed upon deformation of γ' (2H) martensite, using
single crystals of the β_1 phase of a copper-aluminum-nickel alloy with a mar-
tensite point at 8 C. Microspecimens for tensile testing and X-ray structur-
al analysis had a gage section diameter of 0.5 mm, length 8 mm. The X-ray
structural study detected a new martensite phase, established its structure
and determined the mechanism of its formation. Restructuring occurs due to
external stress and formation of the final phase requires a shift after every
6th layer, indicating that the elongation in production of the new phase unit
cell 6 R(1113) from the initial 2H(11) requires a shift of γ = 1/9. When the
tensile axis is oriented at 45° to the plane and the direction of shear (001
[100]), the elongation is about 5%, decreasing with a decrease in the orienta-
tion factor, which agrees well with the experimentally determined elongation
in this transformation.

GENERALIZED ORTHOGONALITY OF HOMOGENEOUS SOLUTIONS IN DYNAMIC PROBLEMS OF
THE THEORY OF ELASTICITY

ZIL'BERGLEYT, A. S., and NULLER, B. M., Institute of Physics and Technology
imeni A. F. Ioffe, Academy of Sciences USSR; National Scientific Research
Institute for Hydraulic Engineering imeni B. Ye. Vedeneyev, Leningrad

[Abstract] A study is made of a system of homogeneous solutions of the prob-
lem of stable oscillations of an elastic strip, the boundaries of which are:
a) fully clamped; b) free of stresses, or c) under conditions a) and b) at
the two ends. The solution is sought in the form u = u(y) exp (px + iωt),
where t is time, ω is the oscillating frequency. In selecting the propagat-
ing wave, it must be considered that almost always the direction of group and
phase velocities is the same, and the Sommerfeld condition is correct, i.e.,
bω/dk > 0 where ip$_j$ > 0. References 15 (Russian).

APPLICATION OF THE THEORY OF THE FUNCTIONS OF TWO COMPLEX VARIABLES TO THE
THEORY OF ELASTICITY

ALEKSANDROVICH, A. I., Moscow Institute of Steels and Alloys

[Abstract] Plane problems of the theory of elasticity represent a special
class of 3-dimensional problems; therefore, it is natural to analyze 3-dimen-
sional problems from the theory of elasticity as a certain particular class
of 4-dimensional problems of the theory of elasticity. The differential
equations of equilibrium are studied in variables for a 4-dimensional elas-
tic medium. The solution of the boundary-value problems of the theory of
elasticity consists in constructing a Hartog area for an assigned 3-dimen-
sional body, in finding the holomorphic shell for the 4-dimensional area
which, generally, has a simpler configuration and, finally, producing a full
system of holomorphic functions for the holomorphic envelope. It is noted
that the classical boundary value problems of the theory of elasticity do not
define the holomorphic functions unambiguously and there is a class of pairs
of holomorphic functions for each problem which yields the same solution to
the boundary value problem stated. Reference 1 (Russian).

NONLINEAR THERMOELASTIC PROBLEM FOR AN ECCENTRIC RING

MEDVEDEVA, N. YU., and KLOYZNER, S. M., Donetsk State University

[Abstract] A study is made of a thin, isotropic, homogeneous plate which has the form of a circular eccentric ring when deformed. The components of the deformation and stress tensors, as well as deformations and displacements, are interrelated by common nonlinear equations. The problem of temperature stresses in the plate is studied. A constant temperature is maintained on the contours of the plate. The problem is reduced to determination of the complex Kolosov-Muskheshvili potentials of the first and second approximations. Results are presented from numerical study of the stress fields in both approximations. A table presents the values of coefficient k in percentages at several points around the contour, expressed as the angle between the positive direction of the abscissa and the vector drawn from the center to the point on the contour in question. Table 1; references 5 (Russian).

ULTRASONIC TESTING OF ELECTRIC-SLAG WELDED SEAMS OF NIPPLES IN THE BOTTOM OF AN APPARATUS OF TYPE 12KhM STEEL

MIRONOV, V. A.

[Abstract] In this work, in order to develop a method of testing, the numerical variation of relative attenuation on ultrasonic frequency is established for various sections of a welded seam made by the electric slag method in 12KhM steel. The transmission of both P and S ultrasonic waves in various zones of the welded seam was tested, as well as the maximum sensitivity of testing and the signal/noise ratio before and after heat treatment of welded joints using both special specimens and chemical apparatus. Testing of welded seams after heat treatment is conclusive and is performed at 2.5 MHz using probes with tip angles of 30, 40, and 52 degrees. This method of testing has been put into industrial use. Figures 6; tables 2; references 5 (Russian).

USSR   UDC   534

STABILITY OF A DOUBLE ROTATING SYSTEM OF SOLID BODIES WITH A MASS IN AN
ELASTIC SUSPENSION WITH RESONANCES

ZAGORODNIY, I. V., Institute of Mechanics, Academy of Sciences Uk SSR, Kiev

[Abstract] A study is made of a system of solid bodies with double rotation,
moving in a slightly elliptical trajectory in a central Newtonian field of
forces. The basic elements are three absolutely solid bodies, an absolutely
solid nonmoving axis attached to bodies 1 and 2, passing through their centers
of mass and coinciding with the axis of dynamic symmetry of body 2; elastic
shock absorbers, which attach body 3 to body 2, which rotates around its
axis of dynamic symmetry at constant angular velocity. It is assumed that
the ellipsoid of inertia of body 3 is a sphere. The stability of the equi-
librium position of this system is studied under conditions such that reso-
nances are present. Conditions of stability are produced and analyzed when
the most typical resonance relationships are realized. Figures 2; references
7 (Russian).

USSR   UDC   [66.023:669.295]:539.4.001.5

STUDY OF THE STRENGTH OF CYLINDERS AND ENDS OF APPARATUS MADE OF AT3 TITANIUM
ALLOY

DANILOV, M. V., KUTEPOV, S. M., and PRITYKINA, L. S.

[Abstract] Apparatus made of VT1-0 and OT4-0 titanium alloys are strength
designed according to standard OST 26-01-279-71. In order to determine
whether it is possible to extend this standard to AT3 alloy, the Scientific
Research Institute for Chemical Machine Building studied the strength of
welded cylindrical bodies and elliptical ends of AT3 sheet titanium. The
vessels were loaded with internal pressure until plastic deformations appeared
in an area with zero moment. Three vessels were loaded to the point of fail-
ure. It was found that the standard could be applied to AT3 alloy, provid-
ing that the permissible stresses be made a function of design operating tem-
perature. A table is presented for calculation of the permissible stress as
a function of temperature. Tables 3; figure 1; references 7 (Russian).

CORROSION-FATIGUE STRENGTH OF DRIVE WHEELS OF BUCKET HYDRAULIC TURBINES

BABACHENKO, V. YE., PUPKO, G. YU., and YAVITS, S. N., Leningrad Mechanical
Plant

[Abstract] Fatigue damage to bucket wheels occurred at one Soviet hydroelec-
tric power station equipped with powerful vertical 6-nozzle turbines using
bucket drive wheels manufactured by welding. The fatigue cracks appeared in
the chamfers between buckets at the point where they were attached to the
rim of the wheel. In order to determine the reason for this fatigue crack-
ing, one of the actual wheels was subjected to a tensometric study under ac-
tual operating conditions, and the fatigue strength of the material of the
wheel was determined considering its manufacturing technology and conditions
of use. It was found that the stresses on the wheel alternated at the bucket
frequency (frequency of appearance of buckets before the stream) and at a
higher frequency, the resonant frequency of the bucket (600-700 Hz); the
wheels were strengthened by local plastic deformation at the point of attach-
ment of the buckets to the rims, resulting in satisfactory operation of the
wheels. Figures 4; references 6 (Russian).

EXPERIMENTAL STUDY OF A D/1=3.38 TURBINE STAGE IN A VARIABLE MODE OF OPERATION

SHNEE, YA. I.(deceased), GARKUSHA, A. V., and SHVEDOVA, T. I.

[Abstract] In an effort to study the problem of improving the output stages of high-power condensing turbines by widening the range of variation of volumetric flow rate (G_v) while retaining flow stability (absence of flow separation) the Khar'kov Polytechnic Institute built a model (1-1) turbine stage cell with low hub ratio (D/1 = 3.38). In the stage the radial gradient of the reaction ratio is preserved by means of a reverse twist of the blading while simultaneously increasing the root zone reaction (with stage reaction of 0.5 - 0.5) and a peripheral lap ($\bar{\Delta}1$ = 0.187 of the height of the rotor blade) with an increase of the angle β_2 at the root and decrease at the periphery. It is assumed that $(G_v)_{comp} < (G_v)_{nom}$, where $(G_v)_{nom}$ is the volumetric flow rate corresponding to the rated output power of the turbine. The problem of the experimental study was to estimate the efficacy and operational stability of the stage in the load range $\bar{G}_v$ = 0.5-1.0, and to determine the influence of the twist of the blading on operational efficiency and flow stability. For this purpose a (1-2) stage was devised that differed only in the variation of the angles β_2 = x(r), which corresponds to a computed mode $(G_v)_{comp} = (G_v)_{nom}$ for c_{2_x} = const with respect to radius, and c_{2_r} = 0. The Reynolds number was varied within the limits $0.85-1.6/10^5$. The maximum efficiency was the same for both stages with cylindrical rings (0.835 - 0.83 for the mode (0.85-0.8) $\bar{G}_{v\ nom}$). The (1-1) stage was found to be superior to the (1-2) stage. The highly stable efficiency of the (1-1) stage in the mode range $\bar{G}_v$=0.7 - 0.49 resulted primarily from the lower energy losses at the rotor because of the absence of flow separation at the root. Figures 8; references 4 (Russian).

SELECTING OPTIMUM CHARACTERISTICS OF THE ELEMENTARY STATE OF A TURBINE FOR
GIVEN VALUES u/C_0 and $\overline{c_z}$

BOYKO, A. V., and GOVORUSHCHENKO, YU. N., Khar'kov Polytechnic Institute

[Abstract] The authors derive formulas for obtaining the optimum character-
istics of an elementary turbine state within a wide range of fluctuation of
the parameter $v = u/C_0$ and of the flow factor $\overline{c_z}$, and demonstrate that the
predetermination of these two parameters, along with the velocity coefficients
φ and ψ, is sufficient for finding the remaining characteristics of the stage
with maximum efficiency. It is further shown that the presence of losses in
the guide vane and rotor blading, as well as their ratio, has a considerable
influence on the magnitude and character of the twist of the flow at rotor
outlet. The exit flow angle (a_2) changes from values less than 90° for high
v-values to values greater than 90° with decreasing v-values. The flow fac-
tor greatly influences the optimum parameters. At a given constant value of
the flow factor $\overline{c_z}$ a maximum of optimum efficiency values is observed, which
shifts with increased flow factor in the direction of lower u/C_0 values and
a diminution of the degree of reaction. Illustrations 2; bibliographies 6
(Russian).

REDUCING THE THERMAL STRESS OF A PISTON WITH A TSNIDI COMBUSTION CHAMBER IN
THE 8DVT-330 SUPERCHARGED DIESEL

LAZAREV, YE. A., BULATOV, B. F., PERLOV, M. L., and ZHUKOVSKIY, S. A., Na-
tional Institute of Motor Vehicles and Engines, Chelyabinsk Tractor Plant

[Abstract] TSNIDI [Central Scientific Research Institute for Diesel Engines]
has developed a combustion chamber shape for diesels which provides good
economy; this shape is used in the T-330 tractor with the ADVT-330 air-cooled
engine produced at the Chelyabinsk Tractor Plant. This article outlines a
method of cooling the piston head by the used of a circular cooling cavity
through which crank case oil circulates in the piston to reduce thermal
stress on the piston while retaining the efficient combustion chamber shape.
Figures 4; references 5: 4 Russian, 1 Western.

USSR   UDC   621.43.068.4

A DEVICE FOR RECIRCULATING THE EXHAUST GASES OF AN INTERNAL COMBUSTION ENGINE

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 35, 25 Sep 77 Author's Certificate No 573606 11 May 76

GUTMAN, A. L., ZHEGALIN, O. I., KAGANOVICH, I. L., LIPKOVKER, L. M., PRESMAN,
V. A., and FRENKEL', A. I., Scientific Research, Design and Technological
Laboratory of Toxic-Gas Engines

[Text] 1. A device consisting of an intake manifold and an exhaust manifold
connected through a bypass pipe with a stop valve inside, the latter inter-
linked through a servomechanism with the engine load setter such as a stem
of the fuel pump in the main fuel feed line, with the distinguishing feature
that, for a more effective and reliable purging of the exhaust gases, the
servomechanism consists of a differential pressure gauge connected to the
main fuel feed line through a sliding distributor with feedback from the stop
valve. 2. The same device, except that the sliding mechanism is a revolving
block with a hole at the periphery and a hole at the center, and with a fly-
wheel connected to the engine load setter. 3. The same device as 1. and 2.,
except that the main fuel feed line is connected to the pressure gauge through
a channel cut in the flywheel.

TECHNICOECONOMICAL OPTIMIZATION OF CRYOGENIC HEAT EXCHANGERS

YEPIFANOVA, V. I., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] A method is shown which extends the thermodynamic optimization of
heat exchangers to the cost optimization of cryogenic heat exchangers, the
largest and most expensive components of apparatus operating at liquid-helium
temperatures. The referred temperature head across the cold and has been se-
lected as the independent variable determining the minimum referred cost and
the product of this variable by the pressure change has been tentatively se-
lected for characterization of exergetic losses, hydraulic plus thermal. The
thermodynamic optimization with respect to the referred temperature head is
based on minimum work. The subsequent technico-economical optimization with
respect to minimum referred cost takes into account the effect of the tempera-
ture head on the heat exchange surface. The heat exchanger is now regarded
as a component of the entire cryogenic system and the temperature head opti-
mized accordingly for minimum overall referred cost. The results of this
analysis and numerical calculations indicate the feasibility of and practical
ways to reduce the variable part of the total cost. Figures 2; references
none.

MATHEMATICAL MODEL OF THE TRANSIENT PROCESS IN A TWO-STAGE CRYOGENIC SYSTEM

NOVOTEL'NOV, V. N., and RYZHKOVA, O. G., Leningrad Technological Institute of
the Refrigeration Industry

[Abstract] A refrigerator is represented as a series of dynamic components,
each with a hydraulic or thermal capacity. Cryogenic apparatus for the 10-
20 K range has the expandor either in series or in parallel. Here an ex-
pandor in series is considered. The dynamic performance of such a system is
calculated on the basis of a combination model, with the thermal transients
in the first (cooler) stage described by linearized differential equations
and those in the last (regenerative heat exchanger) stage described by alge-
braic difference equations. An algorithm has been constructed, and programmed
on a NAIRI-K digital computer, for calculating transients due to load changes.
It takes into account any shift of the expandor operating point as well as the
temperature dependence of the specific heat of the container material (copper)
and the temperature dependence of the gas flow rate. Such calculations were
made for a steep and for a flat compressor characteristic. Figures 3; refer-
ences 3 (Russian).

USSR   UDC   550.834:622.241

A DEVICE FOR ACOUSTIC CORE SAMPLING OF WELLS

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 35, 25 Sep 77 Author's Certificate No 573786 7 Jun 76

DEVYATOV, A. F., SADYKOV, I. KH., and SHIRYAYEV, A. A.

[Text] 1. A device consisting of an instrument probe made up of electro-
acoustic transducers mounted on an acoustic insulator, an oscillator, and
a calibrator, with the distinguishing feature that, for simplifying the prepa-
ration of the device for recalibrations while the centering device is closed,
the calibrator contains both a movable and a stationary sound conductor along
the axis inside the acoustic insulator, these two conductors, being hinge-
joined through intermediate links so that a system of parallelograms is
formed; the calibrator also contains an elastic tension member whose one end
is rigidly fixed and the other end is fastened onto the movable sound con-
ductor, the latter being connected to a pull rod which controls the closure
of the centering device. 2. The same device, except that both the movable
and the stationary sound conductor are made in the form of ribbons, with the
material of each characterized by a different acoustic velocity.

USSR   UDC   534.232

AN ULTRASONIC TRANSDUCER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 35, 25 Sep 77 Author's Certificate No 573747 11 Aug 75

KOSOLAPOV, N. G., and SHCHETNIKOV, A. A.

[Text] A transducer for generating conic waves, consisting of a set of cy-
lindrical conducting layers mechanically interconnected but acoustically in-
sulated from one another, with the base surfaces of all forming an array of
concentric circles in one plane, with the distinguishing feature that, for
widening the range of aperture angles, these layers are made as plates in the
shape of right isosceles triangles with one arm of each arranged in concentric
circles and the other arm of each arranged in parallel straight lines along
the lateral surface of the transducer.

USSR   UDC 534.321.9

A DEVICE FOR TRANSMITTING ULTRASONIC VIBRATIONS INTO A HIGH-PRESSURE CHAMBER

DUBROVIN, M. N., MITSKEVICH, A. M., SOKOLOV, A. M., AFANAS'YEV, S. A., and
GAVRILYUK, YU. N., Order-of-Labor-Red-Banner Moscow Institute of Steel and
Alloys

[Text] A device consisting of a half-wavelength waveguide with a flange at
a quarter-wavelength distance from the free end, with the <u>distinguishing</u>
feature that, for reducing the unproductive waste of acoustic energy and in-
creasing the transmitted power of ultrasonic vibrations, the waveguide flange
is hermetically joined to the high-pressure chamber and has two opposing cir-
cular grooves cut to a depth equal to three quarters of the flange thickness,
the radii of these circles being smaller than the radius of the first nodal
circle of radial flange displacements but larger than the waveguide radius.

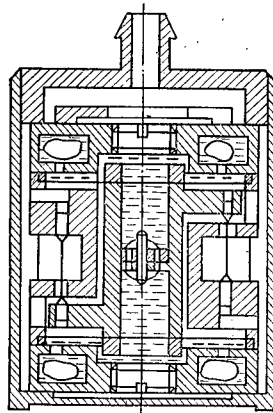USSR   UDC 531.768

A DIFFERENTIAL STRING ACCELEROMETER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 37, 5 Oct 77 Author's Certificate No 575572

ANIKIN, S. A., and MAROVA, N. V.

[Text] An accelerometer consisting of a case, an inertia load on an elastic
suspension, strings with fasteners mounted parallel to the accelerometer
sensitivity axis, and a damper, with the distinguishing feature that, for re-
ducing the overall size, the inertia load is L-shaped and mounted so that the
angle arms of the string fasteners facing the active segments of these strings
lie in two planes perpendicular to the accelerometer sensitivity axis.

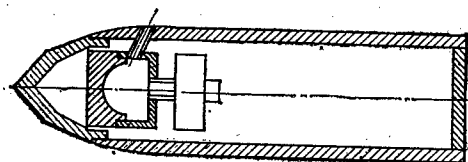USSR   UDC 533.6.078

AN AERODYNAMIC MODEL FOR MEASURING THE PRESSURE DISTRIBUTION OVER A SURFACE

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 35, 25 Sep 77 Author's Certificate No 573732 16 May 75

SHUL'MAN, N. A.

[Text] A model consisting of an axisymmetric shell with a pressure gauge
inside, the latter connected through a pneumatic system to a pickup orifice
in the surface of the model, with the distinguishing feature that, for im-
proving the measurement accuracy, this pneumatic system comprises a chamber
located nearer to the nose cone of the model than the pressure gauge, con-
nected to the latter at the base, connected to the pickup orifice through a
tube sloping at an acute angle toward the axis of the model, and with the
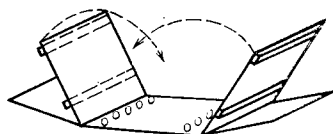top facing the nose cone of the model.

USSR

A PARACHUTE PACK

WAGNER, HUNTER, and HENCHEL, HELMUT, East Germany

[Text] A parachute pack containing a bottom, side, top and lower flaps, installed on the bottom, and additional flaps installed on the bottom at the points of attachment of the main flaps, is distinguished by the fact that to increase the reliability of opening of the parachute, the additional flaps are installed on the same sides as the side flaps, equipped with means for attachment to each other and a means for their attachment to the additional flap which is installed on the side of the lower main flap.
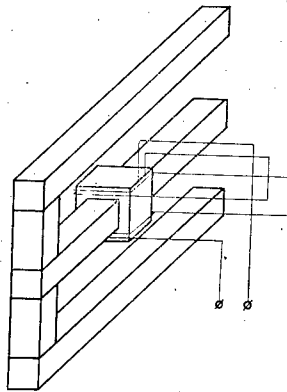
USSR

A LINEAR SPEED SENSOR

MUFAZALOV, F. SH., and AKHMADEYEV, R. V., Ufa Aviation Institute imeni
Ordzhonikidze

[Text] A linear speed sensor as in Author's Certificate No 146608 is dis-
tinguished by the fact that to achieve constant sensitivity along the length
of the magnetic circuit, it is equipped with an additional moving measuring
winding, perpendicular to the main winding and surrounding it, and the wind-
ings are connected in oppositely directed series.

USSR   UDC 621.317.7

AN INSTRUMENT FOR MEASURING THE PEAK VALUE OF AN ELECTRIC SIGNAL

VYASELEV, M. R., DOBROVOL'SKIY, YU. V., CHUGUNOV, I. A., and VINOGRADOV, O.
G., Order-of-Labor-Red-Banner Kazan' Aviation Institute imeni A. N. Tupolev

[Text] An instrument consisting of a trigger circuit in series with a peak
detector, the outputs of the latter connected to memories and its signal in-
put tied to the instrument signal inputs, and an indicator, with the distin-
guishing feature that, for improving the measurement accuracy, it also in-
cludes a circuit for linearly interpolating the line of the residual signal

level, the inputs of this circuit being correspondingly connected to the outputs of the memories and its output being connected to the indicator.

USSR

AN ELECTRONIC CLOCK

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 31, 1977 p 166 Author's Certificate Number 570021

ABRAMOV, K. D., BARZHIN, V. YA., VERBITSKIY, O. G., YELDYSHEV, N. N., and SHILOV, A. YA., Khar'kov Aviation Institute

[Text] An electronic clock containing a master oscillator, frequency divider, logic unit and time mark division unit, connected in series to the output of the master oscillator, an LED indicator and an LED switching unit, is distinguished by the fact that to increase economy of current, it is equipped with controlled pulse generators, a photosensing element and an amplitude regulator, the output of the photosensing element is connected to the input of the amplitude regulator; the output of the amplitude regulator is connected to the first input of the controlled oscillator, the output of which is connected to the indicator, while the second control unit of the oscillator is connected to the output of the LED switching unit.

USSR

A MODULO ADDER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 31, 1977 p 173 Author's Certificate No 570052

ZAKHAROV, YU. L., and ABEL'YAN, V. K., Moscow Institute of Civil Aviation Engineering

[Text] A modulo adder, containing positional and nonpositional adders, a code inverter unit, a positional adder overfill unit, groups of AND and OR gates, the inputs of the code inverter unit being connected to the first number bar, while the control input of the code inverter unit is connected to the control bar, the outputs are connected to the first group of inputs of the positional adder, the second group of inputs of which is connected to the second number bar, while the third group of inputs is connected to the modulus complement code bars, the outputs of the positional adder are connected to the inputs of the overfill unit of the positional adder and the

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first inputs of the AND elements of the first group, the second inputs of which are connected to the first output of the overfill unit of the positional adder, while the outputs are connected to the first inputs of the group of AND elements, the second inputs of which are connected to the outputs of the AND elements of the second group, while the outputs are the outputs of the modulo adder, the first inputs of the AND elements of the second group are connected to the outputs of the nonpositional adder, while the second inputs are connected to the second output of the overfill unit of the positional adder, is distinguished by the fact that to increase speed, the first group of inputs of the positional adder is connected to the outputs of the code inverter unit, while the second group of inputs is connected to the second number bars.

USSR

A DEVICE FOR MODELING OF A THYRISTOR

SHAPIRO, S. V., LOBANOV, YU. V., and SHAYAKHMETOV, R. Z., Ufa Aviation Institute imeni Ordzhonikidze

[Text] A device for modeling a thyristor, containing an operational amplifier, the adding point of which is connected to the input resistor and the voltage supply, is distinguished by the fact that to increase the accuracy of modeling, the feedback circuit of the operational amplifier includes a transistor, the emitter of which is connected to the adding point of the operational amplifier, the base to its output and the collector of the transistor is connected to the control voltage supply.
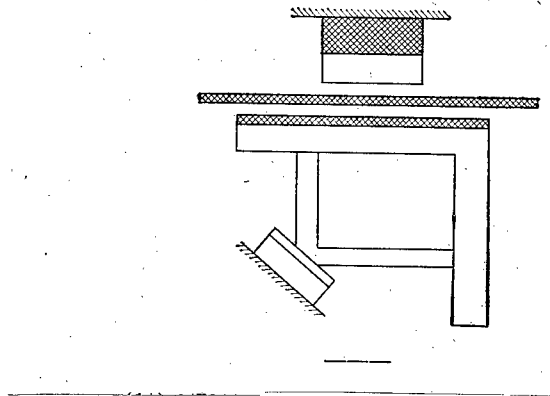
USSR

A TAPE TRANSPORT

VESPAL'CHIK, A. I., VASHCHENKO, L. YE., KUZNETSOVA, M. V., and PUCHKOVSKAYA, O. A., Kazan' Aviation Institute imeni A. N. Tupolev

[Text] A tape transport containing a plate which is elastically attached to the body of a piezo crystal and kinematically to an L-shaped element is distinguished by the fact that to simplify the transport mechanism and increase its effectiveness in operation, the L-shaped element is equipped with a phase-shifting unit, made in the form of two rods of different lengths, located at an angle of 90° to each other, the point of connection of which is attached to the piezo crystal.

USSR   UDC 681.335.8

A FREQUENCY-PULSE MULTIPLICATION-DIVISION CIRCUIT

ANDREYEV, A. P., RODIONOV, V. N., and FEDOROV, M. A., Order-of-Labor-Red-Banner Kuybyshev Aviation Institute imeni Academician S. P. Korolev

[Text] A circuit consisting of two memory triggers, a sign trigger, NANDs, an OR, and an input trigger whose "1" input is connected to the first circuit input, whose "1" output is connected to the first inputs of the first and the second NAND, respectively, and whose "0" output is connected to the first inputs of the third and the fourth NAND, respectively, while the "1" output of the sign trigger is connected to the first input of the fifth NAND and its second and third input are respectively connected to the third circuit input

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and to the "1" input of the sign trigger, with the <u>distinguishing</u> feature
that, for widening the frequency range of the circuit, its first input is con-
nected to the second inputs of the first and the third NAND, respectively, its
second input is connected to the second inputs of the second and the fourth
NAND and to the "0" input of the input trigger, respectively, while the "0"
inputs of the first and the second memory trigger are respectively connected
to the outputs of the third and the second NAND, the "1" outputs of the first
and the second memory trigger are respectively connected to the "1" and the
"0" input of the sign trigger, the "0" input of the latter being connected
to the third input of the sixth NAND, the first and the second input of this
NAND being respectively connected to the "0" output of the sign trigger and
the third circuit input, the output of this sixth NAND being connected to the
first input of the OR and to the first circuit output, and the output of the
fifth NAND being connected to the second input of the OR and to the second
circuit output.

USSR

A DEVICE FOR DAMPING OF THE OSCILLATIONS OF AN OBJECT

GERASIMOV, N. V., and SHATILOV, YU. V., Kuybyshev Aviation Institute imeni
S. P. Korolev

[Text] A device for damping of oscillations of an object, consisting of a
two-chamber pneumatic shock absorber with a bypass electric valve and a unit
to control the rigidity of the shock absorber is distinguished by the fact
that to increase the effectiveness of damping of oscillations with random
perturbations, it is equipped with an acceleration sensor installed on the
object, while the unit which controls the rigidity of the shock absorber con-
sists of a low-frequency filter connected to the output of the acceleration
sensor, aperiodic elements connected in series with the low-frequency filter,
a power amplifier, relay and adder, the input of which is connected through
the corresponding relay to the output of the corresponding aperiodic element,
while the output is connected through a power amplifier to the winding of
the electric valve of the shock absorber.

USSR

A DEVICE FOR RECORDING INFORMATION ON A MAGNETIC CARRIER

KHIL'CHENKO, A. G., and PATSENKER, B. L., Khar'kov Aviation Institute

[Text] A device for recording of information on a magnetic carrier, containing an input register, cycle pulse generator, multichannel recording unit, multichannel reproduction unit with a number of i-channels, the control outputs of which are connected to a synchronous generator, the information outputs to the inputs of the corresponding channel of a majority register, is distinguished by the fact that to increase reliability of the device, it contains a multichannel parallel-to-sequential code converter and a distributor, one control input of which is connected to a cycle pulse generator, while the other is connected to the synch generator, the output of each digit of the input register is connected to the corresponding information input of each channel of the multichannel parallel-sequential code converter, the outputs of which are connected to the corresponding inputs of a multichannel recording unit, the nth output of the distributor is connected to the (n +ia)th inputs of the l-th channel of the multichannel parallel-sequential code converter and the i-th channel of the majority register, where a is the shift in digits of neighboring channels.

USSR

A CONTOUR PROGRAMMED CONTROL SYSTEM

LIKHACHEV, A. A., Moscow Aviation Institute imeni Sergo Ordzhonikidze

[Text] A contour programmed control system containing a program input device, connected to a speed fixer, a control device and a device for regulation of speed of each coordinate connected to the program input device, and a series-connected actuating organ control unit, connected through the velocity sensor to the first comparison unit, actuating organ connected to the fixing device, displacement center connected to the displacement-voltage converter, and a second comparison unit, one output of which is connected through a memory unit to the program input device, while the output of the second comparison unit is connected to the input of the control device, is distinguished by the fact that to increase accuracy and reliability of the system, it includes a functional converter, the input of which is connected to the program input device, series connected first inverter and first adder, commutator and second invertor and the third and fourth comparison units for each coordinate and a

second adder, connected to the functional converter and speed fixer; the output of the second adder for each coordinate is connected through the series connected first comparison unit and a third comparison unit and a third comparison unit, connected to the device for regulation of the speed of the co-ordinate in question, connected to the actuating organ control unit, the output of the second added being connected to the input of the fourth comparison unit, connected to the movement-voltage converter for the coordinate in question, the input of the first adder and the output of the second inverter are connected to the output of the fourth and input of the third comparison units of one coordinate, respectively, while the output of the commutator and the input of the first invertor are connected to the output of the fourth and input of the third comparison units of the other coordinate, and the outputs of the control device are connected to the inputs of the functional convertor, speed fixer and inputs of the memory unit for each coordinate, speed regulation device and setting device.

USSR

AN AUTOMATIC CONTROL SYSTEM

GANIN, I. A., ZAVEDEYEV, A. I., MITROSHIN, E. I., PETROV, B. N., UKOLOV, I. S., Moscow Aviation Institute imeni Sergo Ordzhonikidze

[Text] An automatic control system containing a comparison unit, the input of which is connected to the output of the object being controlled, while the output is connected directly and through a series-connected differentiating device and first adder to the corresponding inputs of the unit which assigns the switchable coefficients, the output of which is connected to the input of the object being controlled, a block for determination of the sign and a block for determination of the modulus, the inputs of which are connected to the output of the comparison unit, a multiplier and a second adder, is distinguished by the fact that to improve the quality of transient processes in the system, it includes a correcting signal shaper, a proportional element, a square-law-function generator and a switch, the first input of which is connected to the output of the comparison unit, while the second input is connected to the output of the unit for determination of the modulus and the first input of the shaper for the correction signal, the first output is connected through a proportional element to the first input of the second adder, while the second is connected through the square-law-function generator to the first input of the multiplier, the second input of which is connected to the output of the unit for determination of the sign and the second input of the correcting signal shaper, while the output is connected to the second input of the second adder, the third input of which is connected to the output of the correcting signal shaper, while the output is connected to the second input of the first adder.

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USSR

A BRIDGE DEVICE

MUFAZALOV, F. SH., AKHMADEYEV, R. V., and PUGIN, A. M., Ufa Aviation Institute imeni Ordzhonikidze

[Text] 1. A bridge device containing compensating and activating organs made in the form of closed magnetic circuits with excitor windings, a recti-fier, the input of which is connected to the measurement winding of a com-pensation organ, and amplifier, a measurement bridge, the outputs of which are connected to the inputs of the amplifier and rectifier, and a recording unit, is distinguished by the fact that to increase sensitivity and speed of operation, it is equipped with a multiswitch and moving coil, connected to the recording unit which encompasses one of the rods of the magnetic cir-cuit of the actuating organ, the ends of the winding of which are connected to the outputs of the amplifier, while the output of the multiswitch is con-nected to the excitor windings of the magnetic circuits.

2. A device as in claim 1. is distinguished by the fact that the measurement winding is made nonmoving, while the excitor windings are multisectional and distributed over the length of the magnetic circuits.

USSR   UDC 681.335

A DIVIDING CIRCUIT

ZARIPOV, M. F., URAKSEYEV, M. A., UTYASHEV, R. I., and DAMINOV, N. S., Ufa Aviation Institute imeni Sergo Ordzhonikidze

[Text] A dividing circuit consisting of a magnetic structure with distributed windings and two movable cores, with the distinguishing feature that, for im-proving the sensitivity of the circuit and simplifying its design, this mag-netic structure is made of two plates between which the two movable cores are placed, one plate bent with a segment parallel to the other plate and a win-dow cut out in this segment for coils to be wound around the longitudinal generating surfaces of this window and connected through separating diodes and a load resistor to an a.c. supply.

USSR UDC 621.976

A SINGLE-BLOW RIVETING HAMMER

MORGOLENKO, A. S., TSYGANOV, V. P., AKHNAZARYANTS, L. KH., and MESHCHERYAKOV, A. N., Kharkov Aviation Institute

[Text] A riveter consisting of a shank and a receiver inside a case, and inside them respectively a head with an annular groove and a floating plunger joined to it, and a mechanism for controlling the hammer head, with the distinguishing feature that, for higher reliability and productivity, the mechanism controlling the head is made of two two-link members located symmetrically with respect to the head axis, in each of which the end of one spring-loaded link is hinge joined to the case and the end of the other link is seated in the annular groove in the head, while the links are spring-loaded against each other.

USSR UDC 621.981.6

A TOOL FOR CRIMPING TUBULAR PARTS

KOGAN, B. YA., Ural Scientific Research Institute of the Pipe Industry

[Text] A tool consisting of a chuck and a coaxial crimping mandrel, with the distinguishing feature that, for improving the product quality, the chuck has a cavity containing sectors which carry jaws arranged around a circle, the sectors with an allowance for axial movement and the jaws with an allowance for radial movement.

A TOOL FOR STAMPING OF PARTS FROM SECTION STOCK

KOMAROV, A. D., SHALAVIN, V. V., KIROV, F. V., PUPYNIN, T. T., and ARONOV,
L. S., Order-of-Labor-Red-Banner Kuybyshev Aviation Institute imeni Academi-
cian S. P. Korolev

[Text] 1. A tool consisting of a universal bin containing an elastic medi-
um, a universal blank plate, and a forming mandrel mounted on that plate,
with the distinguishing feature that, for simplifying the manufacturing pro-
cess, economizing on the consumption of material, and preventing corrugation
along the profile wall during bending, the mandrel is made of two plates
whose shape conforms to the shape of the profile wall and which form a rabbet
for insertion of the profile to be bent, both plates being joined by bolts
so that the rabbet they form can be made larger than the thickness of the
spacer and the profile wall during insertion and removal of the profile part
but made equal to the thickness of the profile wall during stamping, these
plates also being beveled on the outside. 2. The same tool, except that
polyurethane is used as the elastic medium.

USSR

A DEVICE FOR MEASUREMENT OF THE GEOMETRIC PARAMETERS OF PARTS

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 30, 1977 p 100 Author's Certificate No 568836

BUROV, V. N., DMITRIYEV, YU. S., KUROZAYEV, V. P., and SHATERNIKOV, V. YE., Kuybyshev Aviation Institute imeni S. P. Korolev

[Text] 1. A device for measurement of the geometric parameters of parts containing two generators, a transducer intended for installation on the part and made in the form of a coaxially placed exciter winding connected to the generator and two measurement windings, the ratio of the squares of the diameters of which is inversely proportional to the ratio of frequencies of the generators, and two signal processing channels connected to the measurement windings, is distinguished by the fact that to increase accuracy upon measurement of geometric parameters of parts of complex shape, the distance between the measurement windings is selected from the conditions of equality of ratios of the setting gaps to the diameters of the measurement windings.

2. A device as in claim 1. is distinguished by the fact that the sensor is equipped with compensation windings connected in series oppositely directed to the measurement windings and installed coaxially with them in parallel planes, while the channels for signal processing are phase measurement channels and are additionally connected to the compensation winding.

USSR

A DEVICE FOR MEASUREMENT OF THE TEMPERATURE OF THE DRIVE BLADES OF A GAS TURBINE MOTOR WITH A PYROMETER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 30, 1977 p 103 Author's Certificate No 568851

KUMUNZHIYEV, K. V., SAFONOV, V. V., and ZAYEV, A. N., Ufa Aviation Institute imeni Ordzhonikidze

[Text] A device for measurement of the temperature of the drive blades of a gas turbine motor with a pyrometer, containing a photoelectric converter, preamplifier, device for testing operability and an interruptor switch, the input of which is connected to the output of the preamplifier and to one of the comparison inputs of the efficiency testing device, is distinguished by the fact that to increase the accuracy of measurement, it includes a memory device and an amplitude detector, the output of the memory device being connected to the comparison input of the effectiveness testing device, while the input is connected to the output of the amplitude detector, the input of

which is connected to the output of an interruptor switch, while the output of the effectiveness testing device is connected to the control inputs of the interruptor switch and the memory device.

USSR

A DEVICE FOR MEASUREMENT OF THE ELECTRIC PARAMETERS OF BIOLOGICAL SUSPENSIONS AT LOW FREQUENCIES

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 30, 1977 p 114 Author's Certificate No 568907

POZHAROVA, T. A., and MANOYLOV, V. YE., Leningrad Institute for Aviation Machine Building

[Text] A device for measurement of the electric parameters of biological suspensions at low frequencies, containing an operating chamber, two electrode chambers with electrodes and micropore membranes limiting their volume on the side of the working chamber, is distinguished by the fact that to accelerate the process of measurement and increase accuracy, in the device between each electrode chamber and the main chamber there are additional chambers with tubes, and the main chamber is made in the form of a removable cylinder with micropore membranes at its ends.
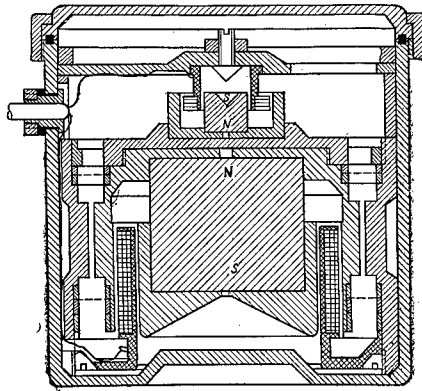

USSR

A SEISMOMETER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 31, 1977 p 156 Author's Certificate No 569981

DARAGAN, S. K., DENISKOV, A. S., NEDOSHIVIN, N. I., and FEDOSEYENKO, N. YE., Institute of Earth Physics imeni O. Yu. Shmidt

[Text] A seismometer containing a body, electrodynamic converter consisting of a magnetic system with a circular gap, pendulum, coil, spiral springs and calibration device made in the form of a coaxially placed magnetic system installed on the pendulum and a cylindrical coil attached to the body is distinguished by the fact that to increase the accuracy of calibration, the calibration device is installed on the converter on the side opposite to the circular gap in the magnet, in a magnetic system which is balanced relative to the vertical axis of the instrument at a distance of no less than the radius of the magnet from the center of gravity of the pendulum.

USSR

A DIGITAL PANORAMIC FREQUENCY METER

FAL'KOVICH, S. YE., PISKORZH, V. V., CHUMACHENKO, A. A., and GORBUNENKO, B.
F., Khar'kov Aviation Institute

[Text] A digital panoramic frequency meter containing two mixers, the first
inputs of which are connected to the source of the frequency to be measured,
while the second inputs are connected to the outputs of a quadrature oscilla-
tor, the output of each mixer is connected through a series-connected low
frequency filter, with a digitizer and analog-to-digital converter connected
to the corresponding inputs of the digital Fourier transform computation unit,
the output of which is connected through a square-law-function generator to
the input of the rough frequency estimation unit, the second inputs of the
digitizers are connected to the outputs of the master oscillator for digiti-
zation signals, is distinguished by the fact that to increase the accuracy of
measurements, it includes an interpolator, one input of which is connected
to the corresponding output of the square-law-function generator, while its
second input is connected to the output of the rough frequency estimation
unit.

USSR

AN ULTRASONIC MULTICHANNEL DEFECTOSCOPE

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 31, 1977 p 147 Author's Certificate No 569939

PAVLOV, S. V., SHOKOV, R. I., VASIL'YEV, N. V., and KUKUSHKIN, V. P.

[Text] An ultrasonic multichannel defectoscope, containing a synchronizer,
an ultrasonic oscillator and scanning generator, a transceiver search device
connected to the ultrasonic oscillator, a time-sensitivity adjuster, amplifi-
er and time selector, a cathode-ray tube connected to the output of the scan-
ning generator, a selecting pulse generator connected to the input of the
time selector and a recorder, is distinguished by the fact that to increase
the reliability of testing, it is equipped with a first coincidence stage,
the output of which is connected to the selecting pulse generator, while
the first input is connected to the synchronizer which is connected to the
first input of the recorder; a flip-flop, the first input of which is con-
nected to the output of the time selector, to the second input of the recorder
and to the cathode-ray tube, whereas the first output is connected to the
second input of the coincidence circuit; a second coincidence circuit, the
first input of which is connected to the second output of the flip-flop, where-
as the second input is connected to the synchronizer and a frequency divider,
the input of which is connected to the output of the coincident circuit,
while the output is connected to the second input of the flip-flop.

USSR

A DEVICE FOR MEASUREMENT OF TWIST ANGLES

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 31, 1977 p 126 Author's Certificate No 569849

MASLEVSKIY, V. I., USOV, V. S., PESHEKHONOV, V. G., ZATSARINNYY, A. V.,
TEREKHOV, S. P., ROSTOPSHIN, A. S., KRASHCHIN, M. D., PANFILOVA, L. M.,
GONCHUKOV, V. B., and STREL'CHUK, YU. I., Moscow Institute of Geodosy, Aerial
Photography and Cartography

[Text] A device for measurement of twist angles containing a transceiver,
including an autocollimation optical system, light source, optical divider
and photosensor located at the output of the optical system, an angle measur-
ing sensor installed on the object coaxially with the transceiver and an elec-
tronic unit connected to the transceiver, containing an amplifier, phase de-
tector and indicator, is distinguished by the fact that to increase the ac-
curacy of measurement and simplify the design, the autocollimation optical
system is made telescopic and equipped with an analyzer-modulator, installed

between the ocular and condensor, which is connected through the optical divider and lens of the optical system to the angle-measuring sensor and to the output of an oscillator in the electronic unit, that is connected to one of the inputs of the phase detector, the second input of which is connected through a narrow-band amplifier to the photosensor of the transceiver.

STUDY OF THE POSSIBILITY OF REPLACING THE WORKING FLUID IN TYPE MP LOADED-PISTON MANOMETERS WITH TYPE PEF NEUTRAL FLUIDS

BAKHVALOVA, V. V., and BOROVKOV, V. M.

[Abstract] The possibility is studied of replacing transformer oil with PEF 70/60 fluid in type MP-60 manometers and castor oil with type PEF 240 or PEF 130/110 fluid in MP-600 and MP-2500 manometers. The influence of the replacement suggested on the metrological characteristics of the instruments and their stability under conditions of long-term operation are studied, and the corrosiveness of the suggested replacement liquids is investigated. All of the suggested replacements can be made, but the MP-2500 manometer, accuracy class 0.05, can be certified for operation with PEF 130/110 only after comparison with a standard manometer. Figures 3; tables 3; references 7 (Russian).

A DEVICE FOR MEASUREMENT OF RADIAL LOADS AND FRICTION LOSSES IN BEARINGS

SAFRONOV, O. I.

[Abstract] A design of a new device for measurement of radial loads and friction losses in bearings is described. A method is presented for determination of the geometric dimensions of the device considering its metrologic qualities. The device consists of a dynamometric unit with elastic sensing elements and attachment parts. The elastic element is made in the form of a wheel with radial spokes, connecting the inner and outer rims. The spokes are rectangular in cross section and placed at intervals of 90°. Tensoresistors are attached to the surfaces of the spokes. The inner rim is a hollow

cylinder, in which the bearing to be studied is placed. As the shaft rotates, in the bearing, the elastic sensing element rotates by a certain angle, and the bending of the four spokes is a function of the friction in the bearing. Proper placement of the tensoresistors eliminates errors. Figures 3; references 4 (Russian).

SPECTROMETRIC METHOD OF DETERMINING THE TRUE VOLUME CONCENTRATION OF VAPOR IN NARROW CHANNELS UNDER HIGH PRESSURES

ZAVAL'SKIY, V. P., Moscow

[Abstract] Conventional γ-radiation methods are too inaccurate for measuring the true volume concentration of vapor in small-diameter (8 mm) pipes under high pressures. With Tu^{170} as the source, not only high-energy β-radiation but also low-energy γ-bremsstrahlung is generated and the latter can be recorded with sufficiently sensitive instruments. This method involves a direct measurement of such γ-quanta passing through a hot test channel, with an error not exceeding 3%. The instrument includes a collimator, a preamplifier, a pulse analyzer, a scaler, a count-rate meter, a photoelectron multiplier with 0.1-0.4 mm thick NaI(Tl) single crystals, a high-voltage rectifier, and two oscillographs. It has been calibrated on the basis of an almost linear attenuation of soft γ-radiation in a two-phase medium. Figures 4; references 2: 1 Russian, 1 Western.

AN ANALOG SEISMOMETER

MEYER, V. V., ZHELUDKOV, N. I., MERKLIN, L. R., SHISHANOV, G. V., and MARINCHUK, V. T., Ryazan Radio Engineering Institute

[Text] A seismometer for a maritime piezoseismographic station with a common busbar, consisting of a distributed piezoelectric two-pole network and an operational amplifier with field-effect transistors at the input, with the distinguishing feature that, for improving the measurement accuracy, there is

a feedback loop around the amplifier consisting of a capacitor in parallel with a resistive T-network, the piezoelectric two-pole network being connected into this feedback loop between the amplifier input and the node point of the T-network, while the shunting element of the latter is connected to the common busbar through an complementary capacitor.

USSR   UDC 621.317.444

A VIBRATIONAL MAGNETOMETER

GRIDIYEV, A. I., and TYURIN, V. M.

[Text] A magnetometer consisting of an electrodynamic vibrator, an excitation coil, a phase shifter whose input is connected to the output of an amplitude detector, and measuring coils connected through an amplifier to the first detector input, the second detector input being connected to the first input of a master-frequency oscillator and the detector output being connected to the terminals of the electromagnet coil through a register and a power supply in series, with the distinguishing feature that, for more accurate measurements of the magnetic quantities, it also includes a selective amplifier, a modulator, and a generator of a reference voltage, the output of this generator being connected to the first modulator input and the second modulator input being connected to the second input of the master-frequency oscillator and the modulator output being connected to the first input of the selective amplifier, the second input of the latter being connected to the phase-shifter output and its output being connected to the input terminals of the excitation coil.

USSR   UDC 621.317:533.275

THE VN-2M MOISTURE METER FOR STREAMS OF OIL

BABAYEV, N. G., GAVRILOV, M. YE., and KULIYEV, B. E.

[Abstract] Measurement of the moisture content of streams of oil is complicated by the fact that the dielectric permeability of the oil itself may vary from approximately 2-2.65. This article analyzes a moisture meter for one grade of oil developed at the Scientific and Production Institute "Neftekhimavtomat" and possible areas of its application. The operating

principle is based on alternating connection of two capacitive sensors, one measuring and one standard, into the grid circuit of a high frequency oscillator operating at 2 mHg. Between the plates of the standard capacitor is dry oil of the same type as that for which the moisture content is being measured. The dry oil must be inserted by the user. The basic technical characteristics of the device are: measurement limit 0-3 or 0-15%; accuracy class 4.0; power supply voltage 220 V_{-15}^{+10}V, 50 Hz; ambient air temperature at 80% relative humidity 5-50 C; temperature of tested oil 0-40 C. Figures 2; references 3 (Russian).

USSR   UDC 531.781.2:539.3

A STRAIN GAUGE

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 34, 15 Sep 77 Author's Certificate No 572643 10 Mar 75

KOSTIN, V. L., MOSKVITIN, A. I., and SOKOLYANSKIY, V. P., Kharkov Aviation Institute

[Text] A strain gauge consisting of an a.c. voltage source, a tensometric bridge connected to it, a control circuit and a linear decoder connected to the input of a null indicator, a generator of clock pulses and a rectifier and a counter connected in series, with the distinguishing feature that, for improving the measurement accuracy, there are also included a switch and an integrator in series, the latter consisting of an operational amplifier with two flip-flops and an integrating capacitor in parallel with it, the output of the tensometric bridge being connected to the input of the switch, the output of the integrator being connected to the input of the null indicator, and the outputs of the control circuit being connected to the input of the a.c. voltage source as well as to the control inputs of the flip-flops.

USSR   UDC 681.335

A DEVICE FOR DETERMINING THE FOURIER COEFFICIENTS OF MECHANICAL VIBRATORY
SYSTEMS

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 34, 15 Sep 77 Author's Certificate No 572796 5 Apr 76

KULIKOVSKIY, L. F., MEDNIKOV, F. M., and BEKASOV, L. S., Kuybyshev Polytechnic
Institute imeni V. V. Kuybyshev

[Text] A device consisting of a carrier-frequency oscillator whose output is
connected to one input of a synchronizer, the other input of the latter is
connected to the output of a low-frequency sine wave generator and its output
is connected to the input of an electrodynamic exciter, this exciter is rigid-
ly fastened to the test object, and on the test object is placed a parametric
displacement transducer whose output is connected through a selective filter
to the input of a resistor, with the distinguishing feature that, for widen-
ing the frequency range, it also includes a frequency multiplier and a modu-
lator, one input of the latter being connected to the output of the carrier-
frequency oscillator, the other input being connected through this frequency
multiplier to the synchronizer output, and output being connected to the in-
put of the parametric displacement transducer.

USSR   UDC 620.178.3

A SYNCHRONOUS ANALYZER FOR VIBRATION DIAGNOSTICS OF ROTATING PARTS

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 37, 5 Oct 77 Author's Certificate No 575501 9 Feb 76

SIDORENKO, M. K., VLASOV, P. P., KAMYNIN, N. A., and FILIMONOV, N. I., Order-
of-Labor-Red-Banner Kuybyshev Aviation Institute imeni Academician S. P.
Korolev

[Text] An analyzer consisting of a vibration transducer and a measuring cir-
cuit in series, and a control channel in which a speed (rpm) transducer, a
shaper of speed signals, a multiplier of pulse frequency by an integer, and
a generator of switching signals are connected in series to the input of the
measuring circuit, with the distinguishing feature that, for making measure-
ments possible without disassembly of the test object, there are also included,
in series, a first delay stage, a second delay stage, a counter, a first co-
incidence circuit, a memory register, a first divider, a trigger whose input
is connected to the speed-signal shaper and whose output is connected to the
frequency multiplier, the second input of the first coincidence circuit being
connected to the output of the first delay stage, a pulse generator with a
second divider, a third divider, and a second coincidence circuit in series

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at its input, their output connected to the counter and the second input of the second coincidence circuit connected to the speed-signal shaper, and a fourth and a fifth divider in series with the input connected to the pulse generator and the output connected to the second input of the first divider.

AN INSTRUMENT FOR MEASURING THE FORCE OF GRAVITY ON A MOVABLE BASE

KRYLOV, G. O., KUZIVANOV, V. A., NAUMENKO-BONDARENKO, I. I., NEMTSOV, L. D., STADNICHENKO, V. N., FOMIN, S. P., CHERNYSHOV, A. V., ZELENSKIY, B. G., VASHCHILOV, YU. YA., and KUZIVANOV, S. V., Order-of-Lenin Institute of Geophysics imeni O. Yu. Shmidt

[Text] A gravimeter consisting of a sensor element in the form of a strongly damped horizontal pendulum, a sensor-acceleration transducer, a sensor-velocity transducer, and a recording device, with the <u>distinguishing</u> feature that, for improving the accuracy by shortening the time period over which the sensor readings are averaged, there are also included a transducer for the vertical velocity of the gravimeter base and a null indicator, the input of the latter being connected to the output of the former and the output of the latter as well as the sensor output being connected to the recorder output.

A SEISMORECEIVER

KOVALEV, O. I., and SHVEDCHIKOV, L. I., All-Union Scientific Research Institute of Geophysical Surveying

[Text] A seismoreceiver consisting of a case, a magnet system, and a movable mass mounted in the case on an elastic suspension of variable-diameter and cylindrical springs, with the <u>distinguishing</u> feature that, for making the frequency and the damping coefficient of the seismoreceiver more stably independent of its angular alignment and of the temperature, permanent magnets facing each other with like poles are mounted coaxially, one on the movable mass and one on the case, oriented in the direction of motion of the mass.

USSR   UDC 621.387.424

A MÖSSBAUER SPECTROMETER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 37, 5 Oct 77 Author's Certificate No 575589 10 May 76

KLYUKIN, N. G., and ORMANDZHIYEV, S. I., Joint Institute of Nuclear Research

[Text] A spectrometer consisting of an electromechanical vibrator on a spring
suspension with a position transducer and a velocity transducer, a terminal
amplifier with a current output and an amplification stage with frequency
correction in the electrical component, with the distinguishing feature that,
for more accurately reproducing the velocity of the moving vibrator element,
the position transducer is made linear and the electrical component of the
spectrometer also includes an amplifier with gain regulation and a summing
circuit, the output of the linear position transducer being connected to the
input of the amplifier with gain regulation and the output of this amplifier
being connected through a complementary summing circuit to the input of the
terminal amplifier with a current output, while the second input of the com-
plementary summing circuit is connected to the output of the amplification
stage with frequency correction.

USSR   UDC 535.822

A MICROFLUORIMETER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 36, 30 Sep 77 Author's Certificate No 574666 17 May 76

BARSKIY, I. YA., VINOGRADOVA, G. N., IOFFE, V. A., and PAPAYAN, G. V.

[Text] An instrument for recording the intensity of fluorescence from several
substances, consisting of a luminaire with a light source and a collector lens,
optical filters, a vertical illuminator, a microscope, and a recording device
with a photoreceiver, with the distinguishing feature that, for reducing the
energy losses and improving the measurement accuracy, it also includes a disk
which can revolve and which contains optical transmitting and blocking filters
mounted pairwise at unequal distances from the disk axis, one part of the
disk being located between the luminaire and the vertical illuminator, its
other part being located between the vertical illuminator and the photoreceiv-
er.

USSR

A VIBRATION TEST STAND FOR STUDY AND CALIBRATION OF VERTICAL SEISMOMETERS

BATRAKOV, V. I., The Lower Volga Scientific Research Institute for Geology and Geophysics

[Text] A vibration test stand for study and calibration of vertical seismometers, containing a base stage and piezoelectric transducers as mechanical oscillation excitors, is distinguished by the fact that to increase sensitivity, interference resistance and productivity of the vibration test stand, two piezopackets are used, consisting of the piezoelements made in the form of discs, separated by a mounting disc applied to one central tensile element attached to the base of the vibrating stand; the stage is supported above the piezopackets by means of a sleeve attached to the mounting disc.

USSR

A DEVICE FOR TESTING THE HEATING OF A TURBINE ROTOR

KOZLOV, V. N., LEYZEROVICH, A. SH. and DAVYDOV, N. I., National Scientific Research Institute for Heat Engineering imeni F. E. Dzerzhinskiy

[Text] 1. A device for testing the heating of a turbine rotor, containing a steam temperature sensor near a characteristic point on the rotor and an analog temperature difference computer is distinguished by the fact that to increase the accuracy of testing, the output of an adder, the inputs of which are connected to the temperature sensor, the output of a computer and the output of an integrator connected by its input to the output of the adder, are all connected to the input of a calculation unit.

2. A device as in claim 1. is distinguished by the fact that the computation unit is connected in the form of a parallel connected amplifier and first order inertial elements.
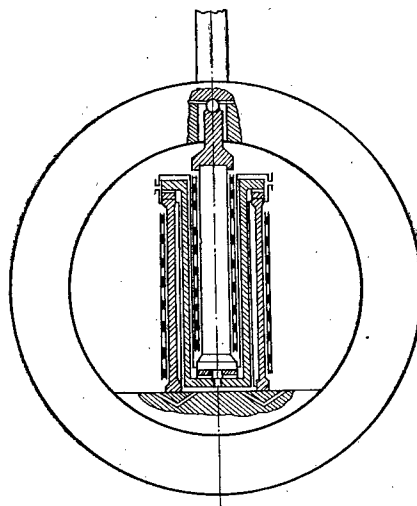
3. A device as in claims 1. and 2. is distinguished by the fact that to increase the accuracy in transient modes, a multiplier unit is connected between the output of the adder and the inputs of the computing and integrating units, the multiplier is connected to a functional converter to the turbine operating mode sensor, for example, to a pressure sensor in the fluid-carrying portion.

USSR UDC 621.515-533.6.071.1

A DEVICE FOR TESTING TURBOMACHINE BLADES

VISHNEVSKIY, G. V., and KRUGLOVA, N. A., Order-of-Lenin and Order-of-Labor Red-Banner Neva Machine Manufacturing Plant imeni V. I. Lenin

[Text] A device consisting of a rotor to which the test blade is fastened and a press inside the rotor for producing a static force on this blade, with the <u>distinguishing</u> feature that, for a more effective testing and for shortening the axial dimension, the press is mounted coaxially with the test blade and heated from a coaxial rod inside as well as from concentrically alternately mounted heating and cooling elements, these elements being separated from one another by cylindrical thermally insulating shields.

HEAT TRANSFER DURING CONDENSATION OF FREON-22 IN A HORIZONTAL PIPE IN THE
PRESENCE OF UNCONDENSED GAS

KAPPEL', A. S., and NEKRASOV, V. P., Astrakhan Engineering Institute of the
Fish Industry and Economy

[Abstract] Experiments were performed on the condensation of technically
pure freon-22 in an experimental installation consisting of a condenser, va-
por generator, water head and measuring tanks, a water pump, a chamber for
preparation of calibrated mixtures and cylinders of argon, freon-22 and nitro-
gen for gas analysis, a vacuum pump, strip-chart recorder, gas chromatograph
and condensate measuring cylinders. The results of the experiments on con-
densation of freon-22 from a vapor-gas mixture showed no significant ejector
action of the condensate film on the vapor-gas layer. Therefore, the addi-
tional thermal resistance at the phase division boundary resulting from the
presence of the vapor-gas layer is of relatively little significance in the
condensation of freons. The presence of gas in relatively low concentrations
(0.5-5.0% by volume) results in a sharp decrease in the heat transfer coef-
ficient and eliminates the positive effect achieved by thinning. This re-
quires the development and introduction of new methods of timely detection
and elimination of air from freon refrigeration systems of medium scale and
large scale cold output. Figures 4; table 1; references 11 (Russian).

AUTOMATIC DEVICE FOR MONITORING THE HYPERELASTICITY PRESSURE OF FLUID VAPORS

SKUBA, B. N., GLADENKO, N. P., and GOLIK, V. V.

[Abstract] To avert the condition when, in a nuclear power plant, the emer-
gency operation of the main circulation pump causes a rapid drop in tempera-
ture and pressure in the circulation loop, whereby the pressure in the loop
reaches the elasticity pressure of the saturated water vapor of the circulat-
ing fluid and a cavitation mode initiates in the main pump, the authors de-
vised an automatic device that monitors the hyperelasticity pressure of the
vapors, shuts off the main circulation pump and prevents start-up when the
hyperelasticity pressure of the vapors of the pumped fluid is above a given
value. The device includes a type TSP-5077 temperature transducer and mag-
netoelectric pressure pickup in the cold pipe of the main pump loop. The
pickup is connected to a secondary MSR1-117 instrument with a differential-
transformer transducer which generates a signal that is proportional to the
temperature-dependent elasticity of the saturated water vapor. The pickup
and transducer are connected to a differential circuit and to a VMD-type

instrument that gives the signal for switch-off or interlock of the main circulation pump. On the basis of laboratory tests the device will reliably start up the main circulation pump when the pressure in the loop is $20 \cdot 10^5$ N/m^2 above the elasticity of the vapors of the pumped water, and shut off the pump when the pressure in the loop reaches $15 \cdot 10^5 N/m^2$ above the elasticity of the vapors, with a relative error of $\pm 1.5\%$ at ambient air temperature of $20 \pm 5°C$ and relative humidity of up to 80%. Figures 2; references 2 (Russian).

HIGH TEMPERATURE TEST STAND FOR MICROSPECIMENS

BEREZHKOVA, G. V., GOVORKOV, V. G., STARITSYN, V. YE., and SHNYREV, G. D., Institute of Crystallography, Academy of Sciences USSR, Moscow

[Abstract] The authors present a description, block diagram, and photograph of the test stand devised by them at their institute for conducting tensile and bending tests in a vacuum ($5 \cdot 10^{-5}$mm Hg) on high-melting materials of micron dimensions (crystal filaments, thin fibers, wires) at constant strain rates (0.001, 0.1, 1.0, and 10.0 mm/sec) and temperatures from room to 2,000°C. The strain gauge used is one designed and built by the Scientific Research and Design Institute for Testing Equipment, Instruments, and Mass Measurement Devices (NIKIMP). The maximum errors in a determination of tensile stress is – 20% and bending stress – 30%, and – 15-20% in a determination of both tensile strain and bending. A diagram showing the percentage elongation at tensile stresses from zero to 100 kg/mm^2 of fibrous crystals of alpha-Al_2O_3 (10.2 x 5-micron cross section) at 1,600°C is given as an example. Figures 3; references 2 (Russian).

USSR   UDC 531.787.91

A PRESSURE TRANSDUCER

CHERNYAYEV, V. N., and GAZEYEV, N. I., Moscow Aviation Technological Institute
imeni K. E. Tsiolkovskiy

[Text] A transducer consisting of a case with a stationary electrode and a
membrane with a movable electrode, with the distinguishing feature that, for
extending its operational temperature range, the stationary electrode is fur-
nished with a heater and the inner cavity is evacuated.

USSR   UDC 66.099.2

A DEVICE FOR PRODUCING A STREAM OF DROPLETS

PEREL'MAN, R. G., DENISOV, YU. D., and BODRYSHEV, V. V., Order-of-Lenin
Moscow Aviation Institute imeni Sergo Ordzhonikidze

[Text] 1. A device consisting of a chamber with droplet fractioning heads
coupled to a vibration source, and a main feed line with a drive, with the
distinguishing feature that, for wider ranges of droplet dispersion, stream
density, and spray uniformity, the droplet fractioning head at one end of
the two-arm lever comprises a wall with tubes of various diameters mounted
on it, each tube being connected to the vibration source, while the main
liquid-feed line is spring loaded and coupled to the drive through a profiled
cam. 2. The same device, except that the cam profile are two mirror-image
segments of an Archimedes spiral.

USSR

A DEVICE FOR TESTING TECHNOLOGICAL PARAMETERS

GAVRILOV, A. N., LOMAKIN, B. I., SAVVIN, B. S., SIMONOV, V. A., and TOLOCHKOV,
YU. A., Moscow Aviation Institute imeni Sergo Ordzhonikidze

[Text] A device for testing technological parameters, containing an apparatus
for measurement of peak values of parameters, the input of which is connected
to the axial force sensor, the first output is connected to the first input
of a threshold unit, while the second output is connected to one input of the
stopping unit, the other input of which is connected to the cycle sensor,
while the output is connected to the control unit and the output of a thresh-
hold unit, and a first level sensor connected to an indicator and a second
input of the threshhold unit, is distinguished by the fact that to increase
reliability of testing, it contains an accumulating adder, an adder for suc-
cessive increases, a second level fixer and a level discriminator, the first
input of which is connected to the first output of the peak parameter value
measuring device, the second input is connected to one output of the second
level fixer, the other output of which is connected to the indicator, the
output of the level discriminator is connected through the accumulating adder
and the successive increases adder through their outputs to the control unit
which is connected to the indicator.

USSR   UDC 621.791.75.9

AN AUTOMATIC REGULATOR FOR GUIDING AN ELECTRODE ALONG THE CONTACT

SERGEYEV, YU. YE., CHUSHKIN, V. N., RIKUR, E. A., ARDASHIROV, N. SH., and
UZYANBAYEV, A. KH., Ufa Aviation Institute imeni Sergo Ordzhonikidze

[Text] An automatic regulator consisting of an amplifier, an electromechani-
cal device for moving the welding electrode, and a high-frequency current
generator, with the distinguishing feature that, for more accurate tracking,
an oscillatory circuit is connected to the amplifier input and a capacitor
and a slip ring are connected in series with the generator and the welding
electrode.

USSR   UDC   626.862.2

USE OF A LASER IN UNDER-DRAINAGE WORK

Moscow GIDROTEKHNIKA I MELIORATSIYA in Russian No 2, 1977 pp 69-73

YEFREMOV, A. N., MAMMAYEV, Z. M., GORDEYEV, D. V., and MARMALEV, A. I.

[Abstract] A description is given of the many advantages of the use of a laser over the use of the most common wire system for controlling the depth of drainage excavations, particularly with the use of the ETTs-202A combined excavator/pipe layer. Field tests with the LG-44 helium-neon laser (0.63-micron wavelength, 3 mw power) in the construction of the "Portsevka" drainage system show that the laser indicator has a control range of 700 meters, an average local deviation of the bottom of not more than 0.67 cm, and mean angular deviation of 0.00026. The width of the control zone was 0.35 m at a distance of 30 m from the laser level indicator and 4.2 m at the maximum distance of 700 m. During the field tests a total of 3.5 km of drain system was constructed. Illustrations 2; table 1.

USSR   UDC   621.317.1

A LUMINOUS INDICATOR

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 36, 30 Sep 77 Author's Certificate No 574612 19 May 76

DREMINA, V. M., ZARAKOVSKIY, G. M., and DOROSHENKO, I. YE., Leningrad Institute of Aviation Instruments

[Text] An indicator consisting of a matching circuit, an amplifier, a control circuit, and a linear gas-discharge lamp, all in series, the output of the control circuit connected through a feedback loop to the second amplifier input, with the distinguishing feature that, for expanding the range of its functional applications, there are also included a programmer, a comparator whose inputs are connected to the outputs of the matching circuit and of the programmer, respectively, also a frequency-dependent generator whose input is connected to the comparator output, and a commutator inserted between the control circuit and the gas-discharge lamp, the input of this commutator being connected to the output of the frequency-dependent generator.

Power, Engine, Turbine, Pump

A SPRAYER FOR ATOMIZING HEAVY LIQUID FUELS

AKHMETSHIN, R. M., SHAYKHUTDINOV, Z. G., SABUROV, I. S., POLESHUK, I. Z.,
and KASHAPOV, R. S., Bashkir Scientific Research and Design Institute of the
Petroleum Industry; Ufa Aviation Institute imeni Sergo Ordzhonikidze

[Text] A sprayer consisting of a cylindrical premixing chamber with an array
of air vents in its lateral wall, a fuel nozzle along its axis, and a whirler
at the exit from it, with the distinguishing feature that, for preventing
separation of the liquid phase from the chamber wall and for producing a
finely dispersed flame, the air vents are radial and the whirler is a multiple-
thread as, for example, a three-thread type with a central feed-through chan-
nel.

VIBRATION CHARACTERISTICS OF 500-MW TURBINE UNIT

RUNOV, B. T., KOVAL', G. S., SALIMON, A. V., and KORABLEV, V. I., National
Heat Engineering Institute; Urals Affiliate of National Heat Engineering
Institute

[Abstract] Combined vibration testing of a 500-MW turbine unit was under-
taken at the Troitskaya Regional Electric Power Plant. This unit was de-
signed in consideration of earlier vibration testing of 300-500 MW units and
is not a traditional design: it has a four-bearing system, with two turbine
rotors, a welded low-pressure rotor system and additional columns beneath
the turbine supports designed to give the foundation greater rigidity. The
results of the study showed that the level of dynamic compliance of the foun-
dation in many cases is significantly greater than the design level. The
vibration reliability of the K-500-240-2 turbine is significantly improved
over the previous models. The design changes have decreased mutual influence
of groups of rotors by distributing their natural oscillating frequencies
through the spectrum, increasing the stability of the operating conditions of
the turbine by increasing the dynamic rigidity of the supports and foundation,
eliminating angular deformation of cross bars, by the use of a system of hy-
drostatic lift support and shielding of the foundation. To minimize vibra-
tions of these turbines still further, the thermal stability of the generator
rotor should be improved and the resonant frequency of its supports detuned
from the operating frequency of 50 Hz; heat insulation of the foundation
should be improved by special coating, ventilation and screening.

STUDY OF THE HEAT-PRODUCING PORTION OF A GT-100-750-2 GAS TURBINE

OK'KHOVSKIY, G. G., and MEKHANIKOV, A. I., National Heat-Engineering Institute

[Abstract] Some of the heat generated by gas turbine installations at heat
and electric power plants is used to heat water as a heat supply for buildings
and other structures in the area. This article presents the results of a
study of the testing of the GT-100-750-2 gas turbine as concerns its heat
production. Under the test conditions, with an electric load of 100 MW, the
gas turbine had a thermal load of 105 MW and an efficiency of 40% (consumption
of standard fuel 310 g/(kW·hr)), 32 MW of heat were removed from the heat pro-
ducing section of the air collers, 73 MW from the section which heats water
by means of the heat contained in the exhaust gases from the turbine. The
electric load of the gas turbine is reduced by approximately 3 MW when it is
used as a heat supply. This drop in electric load is also accompanied by a
drop in the thermal load of the exhaust gas water heaters; an overall fuel
savings of 180-150 g/(kW·hr) is realized. Elimination of gas leakage through
exhaust valves will allow the electric load of this turbine to be increased
to almost 125 MW. Additional improvements include improvement of the heat
insulation of the heat exchangers, improvement of heat exchange in air cooler
No 2 and in the exhaust gas heating sections. Figures 5; table 1; references
2 (Russian).

A VAPOR-OIL DIFFUSION VACUUM PUMP

POKROVSKIY, A. A.

[Text] 1. A pump consisting of a cooled case with a boiler in the lower part
and a vapor duct along the axis, and with nozzles, with the distinguishing
feature that, for the prevention of eruptive boiling of the working liquid,
a concave disk with circular grooves is dropped to the bottom of the boiler
with the bulge up. 2. The same pump, except that there is also a groove in
the lateral surface of the disk. 3. The same pump, except that in its multi-
stage version with coaxially installed vapor ducts, grooved rings are dropped
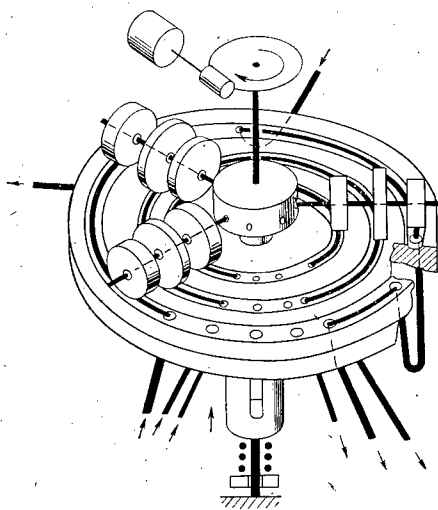into the boiler between the vapor ducts.

USSR

A PERISTALTIC PUMP

BULATOV, YU. A., Leningrad Affiliate of the Special Design Bureau for Automa-
tion in Petroleum Processing and Petrochemistry

[Text] 1. A peristaltic pump for feeding several liquids in an assigned
ratio, containing a rotor with an extractor installed on an axis, interact-
ing with elastic pumping tubing placed in concentric circular slots made in
the supporting surface of a body is distinguished by the fact that to expand
the range of variation of relationships of deliveries of the components,
there are several apertures for output of the ends of the tubes in each cir-
cular slot.

2. A pump as in claim 1. is distinguished by the fact that the rotor is
equipped with additional extractors and has an aperture to carry their axes.

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USSR   UDC 621.226.5

A PUMP-BOOSTER

Moscow OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in
Russian No 36, 30 Sep 77 Author's Certificate No 574551 24 Sep 73

PIKULIN, V. N., Kharkov Aviation Institute

[Text] A pump-booster for actuation of clamps, for instance, consisting of
an actuating cylinder and a pumping cylinder with active cavities each, their
pistons being joined to one another, with the distinguishing feature that,
for regulating the exit pressure and the volume of fluid displaced by one
active stroke, under a constant inlet pressure and a constant travel as, for
instance, in the case of operation with hydraulic systems of superposable
clamps, there is also furnished a drum which can revolve about its shaft and
inside which pump cylinders of various diameters are placed, their pistons
being joined through separable sonnectors such as a plug-and-socket pair,
for instance, and the active cavities in the pump cylinders being connected
to a channel in the drum along, for instance, the hollow shaft of the latter.

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